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Inducting the Next Generation of Leaders

SOME interesting indications are derivable from a survey of the courses conducted by the electric utility companies to train selected groups of college graduates for usefulness in the business. The aims are stated by the surveyor to be the quick development of capable human material from a group conceded to be, on the average, more readily susceptible than others to the learning of new duties and responsibilities—namely, the college graduates.

It does not look, however, as if the college departments from which the men are selected are as numerous and varied as those in the utility business through which they are routed to acquire familiarity with all its phases. In this the engineering schools and departments will find pardonable pride and considerable confirmation of their claim that engineering education is the best preparation for any line of business, certainly for those industries like the electrical which are so inescapably technical in foundation and manifestation. The electrical manufacturing companies are known to be employing and assigning to their cadet courses the graduates from other than the general and differentiated engineering courses, but then again their problems in production management, sales, advertising and cost accounting are more prominent than those of the utilities. Nevertheless, the trend is noticeably toward a reduction in this disparity, and we may look for an increasing proportion of economics and even classical graduates in the utility business, although they may not enter and progress through the organized utility school.

The fact that such a large percentage (70 to 100, with the average closer to the latter figure) of the men remain with the company at the close of the course may be taken as indicating one or more of several things. These include general confidence in the future of the business, particular confidence in the employers and especially those officials with whom the students are permitted to make contact, and efficacy of the course itself in sustaining an aroused interest and showing the integrated functions of the branches of the business. A more significant index is the high percentage of all who have taken the courses still remaining with the same companies.

The pay is generous in view of the admittedly poor productive value of the student during the term of the course. In general, however, it seems there might be a somewhat greater increase than the $15 per week additional when the student is assigned to his first real job. Of course, the explanation is that the delayed acceleration is dictated by the need of recovering lost investment. One company, however, reports doubling the beginning wage when the course is completed. If the course fulfills its aim why should not one who completes it satisfactorily have gained enough perspective and balance to be able to earn honestly double the subsistence wage initially paid?

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Saving at One End

ALL branches of the electrical industry are efficient in production and inefficient in distribution. The brains of executives and engineers have focused on production and let distribution care for itself. The result is that the economic future of the industry as it operates today will be shaped by the successful solution of the distribution problem.

What is wrong with distribution? In terms of general industry the Department of Commerce puts its finger on several facts. Some of them are startling. For example, 25 per cent of the credit sales and 6 per cent of the cash sales in this country lead to the return of goods. The major cause is that inadequate lighting does not permit customers to make a careful examination of purchases. Careless salesmanship ranks second to this indictment of the electrical industry.

About four hundred million dollars is lost yearly through inefficient credit methods. Yet the automotive industry loses only 0.3 per cent through installment sales that amount to half the total of all industry. No one knows where the electrical industry ranks in this classification. Accurate cost-accounting methods for production and sales costs are prevalent among companies that are in a precarious financial condition.

These general distribution faults in all industry can be outlined at length. They apply to the electrical industry, and other faults peculiar to that industry are in evidence. Straight-line distribution, selective selling, volume insanity, group competition, disorganization, personalized selling and many other technical terms of distribution have a tangible meaning to students of the subject, but are meaningless to those responsible for the distribution practices.

Facts about distribution in the electrical industry

should be added to facts about distribution in all industry. Work should be done to put distribution faults in terms of dollar loss. Organization should be perfected and practices instituted to eliminate these losses. It can be asserted confidently that the elimination of each loss will save dollars and will open the door of opportunity to sell more business—witness the effect of lighting on the volume of returned goods. Thus the electrical industry can operate more economically in its internal affairs and increase its sales to all business if it will go to work and solve its distribution problem. It can be a shining example of good distribution instead of one of the best examples of bad distribution.

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Power Companies Cannot Afford to Encourage Bootleg Wiring

WHEN the five-and-ten-cent and other chain stores first began to sell wiring material—sockets, switches, fuses, lamps and wire—to the public, electrical men were very much disturbed. To invite the householder to do his own wiring opens up alarming possibilities. For such circuit extensions go in without supervision or inspection. Workmanship is crude and careless. Joints are not soldered. Fire and life hazards are involved, and the trouble-call records of any large city power company show how real the danger is.

There are only three ways for the electrical industry to deal with the economic and actual menace of this situation. One is to ignore it, let the public buy when and what it will and bootleg its wiring extensions, and trust to the trouble calls and chance inspections to correct the faults. This has been the common method. And it has been going on so long now that manufacturers, wholesalers, utility men, and even contractors in most cities, have come to take it as a matter of course.

The second method is to accept it and compete with it, and in some cities power companies and some contractors and wholesalers are actively selling such materials themselves over the counter to any buyer. They argue that it is better that the handy man should buy standard stuff and be told to be careful and to have his work inspected than for him to buy, anyway, something more hazardous with no advice.

The third method is for the electrical industry in the community to face the danger openly and spend money to educate the local public to the value and importance of quality in wiring materials and responsible workmanship. It goes without saying that the latter is the only course that offers any constructive progress toward correcting the evil. That it can be done with the whole-hearted support of the industry and good promise of public response is made clear by the very courageous and intelligent campaign of advertising that is now being conducted in Boston by the Metropolitan Electrical League—a direct appeal to the common sense of the householder.

A policy of action appeals to every normal man. And since the public runs these risks only because it does not understand the danger involved, the Boston campaign is a logical corrective. For the electrical industry supinely to do nothing is absurd and indefensible; but for a power company to itself sell sockets, switches, wire and loom to amateurs, so that they may go adventuring in electrical wiring, is putting the stamp of high approval on a very dangerous practice. It is in direct conflict with the whole spirit of codes and ordinances. It is a rank injustice to the contractor who is endeavoring to maintain sound standards of safety and to co-operate with the utility in promoting more adequate installations.

If we are ever to have popular appreciation of the benefits of ample installations, complete equipment and a satisfying service, electrical men must have the courage to face the selling of larger wiring systems in the home—systems that naturally cost more. The power companies particularly should discourage the idea of makeshift extensions. They know the dangers.

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Thoughtless Fire Protection

THERE is more to fire protection than a desire to get low insurance rates. It should be a basic design factor in the attempt to supply continuous service. Insurance rates and the protection of equipment are desirable ends in themselves, but a reduction in the number of outages and the time of each outage is the major objective to be sought in each electrical installation.

Fire protection should be an element in the original design specifications and not an afterthought. It should rank equally with flexibility, isolation, relaying and control. It should be built into the structural and apparatus assembly to afford an adequate and permanent means of reducing service outages should fires occur. It should operate without involving life hazards to employees and with a minimum amount of human aid. This means more than the adoption of a sprinkler system in a fireproof building. Electrical apparatus contains much oil and in itself has great potentiality for disruptive forces. To protect against these hazards is a major engineering task, yet most electrical assemblies fall below the adequacy of fire protection installed in fireproof buildings. In the majority of electrical installations it is a matter of opinion or the hit-or-miss use of a few portable extinguishers, and there is a dearth of the built-in type of fire protection that is so advisable. The truth of this assertion is evident in the article discussing fire protection printed in this issue of the ELECTRICAL WORLD.

It should not take a disastrous fire to start thinking about fire protection on the lines of engineering. There is every incentive from a service, a life-hazard and an economic point of view to study what may be done with adequate safeguards for each kind of electrical instal-

lation. If fires cannot be prevented, then the extent of damage can be limited, and above all the outage time can be reduced. It is reasonable to assert that thought and action are called for.

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Customer Ownership Should Be Pushed

THE tendency in public utility financing during the last five years has been away from bonds and more and more toward stock. That is to say, while the total public offerings this year for all utilities were 50 per cent greater than they were five years ago, three times as much money was procured through the sale of stock in 1929 as in 1925. The total bonds issued were approximately $60,000,000 less.

This is as it should be. The utilities should be popularly owned; the owners should be partners and not creditors—stockholders and not bondholders. Of course, an ideal credit condition is attained when the utility is financed entirely through the sale of capital stock; but few utility companies have as yet reached that goal, although many have that objective in view. On the other hand, the greater the bonded indebtedness and the smaller the stock issued, the higher the dividend possibility.

However, the market situation in 1930 will be the determining factor as between bonds and stocks, and not the wishes of the management. Preferred stock is generally attractive to investors at all times, and its sale to customers and employees should be pushed with renewed vigor. It is a great mistake for utility companies to neglect this phase of public utility financing for any reason whatsoever.

The cost to the utility may be a trifle higher than that of bonds or common stock, but from every angle of public utility management and operation customer ownership is most desirable.

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Four Walls Do Not Make a Substation

JUST how far a utility company is justified in going in order to satisfy the wishes of those of the public who must be intimate neighbors with a substation, a generating plant, a transmission line or an overhead distribution system is largely a debatable question. The executive attitude in general is to meet the wishes of the community or even to exceed them, although notable exceptions to this viewpoint are not undiscoverable. It is therefore necessary to assume that failures to do the desirable thing are failures due more often to lack of knowledge than to indifference.

The discussion which R. B. Horner contributes to this issue of the ELECTRICAL WORLD is indeed worthy of note, for he has shown conclusively that thoughtful efforts by skillful architects may make a substation a thing of character for which no apologies need be made to any one. No damning charge of wasted money may be made against Mr. Horner's examples, for foremost among his guiding principles has been the honest avoidance of such an indiscretion.

Engineers, and not architects, have too often dictated the appearance of utility structures, and the efforts of the non-artistic engineers to produce attractive buildings have frequently been pitiful failures, savoring of "what might have been," for that very reason. There is little to be added to the admirable case that Mr. Horner has presented, though there are utility men who will look upon such structures as he advocates as wholly unwarranted. That a substation can be built in a high-class residential or commercial district without rendering its presence an affront has been demonstrated, and that even the least prepossessing surroundings may in time become so improved as to demand far-sighted planning should not be overlooked.

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Economic Approach to Peak-Load Problems

PEAK loads will probably persist in the electric utility field as they have done for years in other lines of endeavor. But the expense which they incur should serve as a constant stimulus to ingenuity in smoothing out demands and in handling more economically the peak demands which remain. Already interconnection of plants and systems, establishment of off-peak rates and application of electricity to operations that can be performed between 10 p.m. and 6 a.m., or other valley periods, have improved the situation considerably on some properties. But a big task remains—that of convincing both utilities and industrial establishments that these and other off-peak usages of electricity can be more extensively applied.

In this issue another method of handling peak loads economically is outlined in an analytical, economic way by Dr. P. H. Schweitzer. He recognizes present methods and briefly comments on them, but shows his courage in devoting particular attention to the possibilities of Diesel engines.

Dr. Schweitzer has based his analysis on actual operating conditions in this country and has attempted to rest his conclusions upon the most authentic operating costs. Considering a 20,000-kw. plant with definite load conditions, he has concluded that the most economical operation is obtained with a 60 to 40 ratio of steam to Diesel, but points out that a high saving can also be made with only 10 to 20 per cent Diesel equipment.

Whether engineers will agree with Dr. Schweitzer's figures or his conclusions is not so important as it is that they recognize the value of an economic analysis like he presents of this all-important problem of handling peak loads economically.

Courtesy Edison Lamp Works

Milan Cathedral
Floodlighted
Light's Golden Jubilee

A Merry Christmas to All

Diesel Engines for Peak Loads

By Dr. P. H. Schweitzer
Pennsylvania State College

THE handling of the peak loads has always been one of the vexing problems of the central-station industry. Even with the present diversity of demand on large central stations, the maximum load is usually twice and sometimes three times the average load, consequently the generating equipment has to be laid out two to three times larger than it would need to be if the demand were uniform. This frequently involves a correspondingly greater capital outlay. When the generating equipment is operating under low load its efficiency is lower. In order to supply peak load demands steam central stations are frequently required to fire up boilers from cold or keep boilers banked during many idle hours or do both.

For these reasons the economy of steam central stations depends very largely on the plant capacity factor, i.e., the ratio of the average load to the plant capacity. The cost of generating 1 kw.-hr. is at least 3½ times greater with a 10 per cent plant capacity factor than with a 50 per cent plant capacity factor. High peaks lower the capacity factor considerably. Therefore the peak load problem deserves utmost attention.

The ideal solution would be to do away with the peaks or flatten out the load curves. It is gratifying that system interconnections and the increasing diversity in the use of electricity have a tendency to flatten out load curves. This tendency has been accelerated by the public utilities by proper rate policies. Lower industrial rates and the increasing use of electric appliances encouraged the off-peak use of electricity so much that the former off-peak hours became peak hours later. Many public utilities charge special rates from midnight until 6 a.m., which has more of the desired effect. The average capacity factor of the central stations in the United States increased from 25.4 per cent in 1907 to 33 per cent in 1927 and is higher than in any other country. Yet until we can eliminate the clouds, rains and thunderstorms, the rise and set of the sun and the variation of seasons we cannot hope that high peaks on our load curves will be entirely eliminated.

Very little attention has been given to Diesel engines in facing the peak-load problem because of their high first cost and limited capacity. Recently, however, the Markische Elektricitäts Werke installed two 11,700-hp. engines of this type for peak-load service. Furthermore, the cost of Diesel engines has gone down markedly in the last few years and dependable units are now available in ratings of several thousand horsepower.

Based on actual operating costs of American central stations, Dr. P. H. Schweitzer has analyzed the power costs of "mixed central stations" and found that by combined steam-Diesel operation considerable saving can be effected. While some figures selected may be considered too low by some operators and too high by others, substitution of other figures will not affect the results appreciably.

Peak-Load Units Available

Another solution of the peak-load problem is the use of special peak units for the supply of the peak load. Several types of peak units are used by steam stations. The principal ones are:

1. Steam accumulators with accumulator turbines.
2. Hydraulic accumulators with pumps and water turbines.
3. Electric batteries for direct current.
4. Semi-obsolete steam equipment.
5. Special peak turbines with peak boilers.
6. Diesel engines.

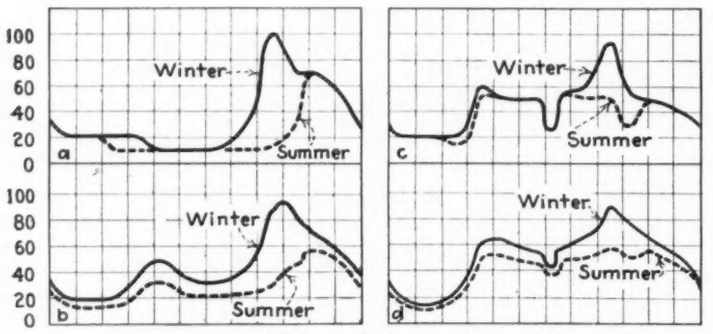
The economy of the steam accumulator peak-load plant is in many cases surprisingly good, as shown by A. G. Christie (*Mechanical Engineering*, December, 1928, page 914), but "it loses its advantage if the base of the peak that has to be carried exceeds four hours per day." Hydraulic accumulators and electric storage batteries are costly and the former are feasible only when geographic conditions permit their use.

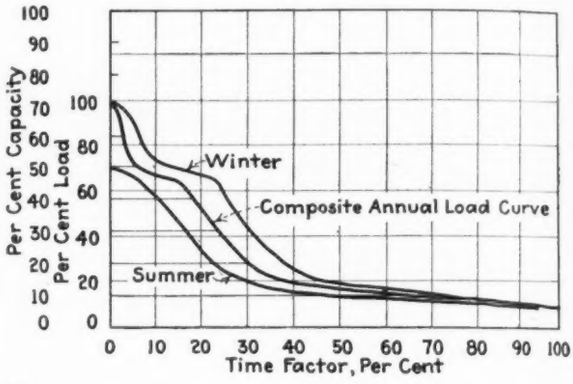
The last three types of peak units are prime movers themselves, therefore they can be used for a double purpose—to supply the peak load and to supply the base load in case of a partial breakdown. It is so important to provide for such an emergency that the accumulator types of peak units have not found much favor with American central stations.

Semi-obsolete steam equipment is quite generally used for peak-load units. When old and inefficient units are available it is economical to take care of the growth of the load by adding to the base capacity and converting some of the older units into peak-load equipment. Since the investment in these units has

usually been charged off in the obsolescence fund the capital investment is low. Their disadvantage is the high operating and maintenance cost. The firing up and the banking of boilers involve high fuel and labor unit costs and the repair costs on old equipment are high. Unless a considerable capacity of the peak boilers is kept under fire continuously, the meeting of unexpected demands, like "thunderstorm peak," causes difficulty. However, the low capital investment as a rule outweighs these disadvantages.

The practice of adding efficient base-load units and carrying the peak load on semi-obsolete equipment has been justified in view of the ever-increasing system load





(a) Lighting	
Daily Load Factor	Per Cent
Winter...	35
Summer..	32
Average..	33
Weekly Load Factor	Per Cent
Winter...	30
Summer..	27
Average..	28
Annual L. F. ..	23

(b) Lighting and City Railway	
Daily Load Factor	Per Cent
Winter...	47
Summer..	51
Average..	50
Weekly Load Factor	Per Cent
Winter...	43
Summer..	46
Average..	45
Annual L. F. ..	32
Diversity, winter..	108
summer	120

(c) Lighting and Industrial	
Daily Load Factor	Per Cent
Winter...	49
Summer..	71
Average..	64
Weekly Load Factor	Per Cent
Winter...	45
Summer..	65
Average..	59
Annual L. F. ..	40
Diversity winter..	107
summer	154

(d) Lighting, Industrial, Interurban and City Railway	
Daily Load Factor	Per Cent
Winter...	58
Summer..	72
Average..	67
Weekly Load Factor	Per Cent
Winter...	53
Summer..	65
Average..	61
Annual L. F. ..	45
Diversity, winter..	112
summer	141

Figs. 1 and 2—Four Typical Load Curves and Composite Result

Forty-one per cent, which represents the average excess capacity of medium large stations, has been added to the peak of the composite annual load curve. Then the total capacity was divided into ten parts. Each division line cuts the whole area covered by the composite curve and the axes in two. The output represented by the lower area is supplied by the base unit and that represented by the upper area by the peak unit.

factors and the rapid advances in steam engineering, which made the replacement of the older units by modern ones particularly attractive. However, if the demand for electricity grows faster than the obsolescence of the generating equipment in use, either because of an exceptionally rapid increase of the population (as in Florida) or because of a reduction in steam generation development (in such case obsolescence does not work so fast), the economical procedure would be to add peak units instead of base units. The outside purchase and installation of a semi-obsolete steam-generating equipment for peak service would seldom be justified.

Specially constructed peak boilers which are inexpensive and heat up quickly, having small water and iron masses and possibly no brick wall, combined with inexpensive steam turbines, would represent an ideal peak-load equipment. However, a technical solution of this problem is still missing and it is doubtful if it will be available in the near future.

Diesel Engines for Peak-Loads Abroad

Recent developments abroad have made some central-station operators wonder if the large Diesel engine could solve the peak-load problem better than current methods. There are many points in favor of the Diesel engine:

1. It requires no heating up and can be started from cold to full load in a few minutes.
2. No fuel loss and only minimum attendance during the no-load period.
3. High thermal efficiency which is practically independent of the size and does not decrease with the age.
4. Easy storage of the fuel.
5. It can be placed at a considerable distance from the base unit if desirable, in this way saving electric transmission costs.
6. In case of a change it is easier to move, to transport or to dispose of than steam equipment with built-in boilers and condensers.

These qualifications of the Diesel engine as a peak-load equipment have been appreciated more abroad than in this country. In Germany, France and Spain Diesel engines of several thousand horsepower have been in successful operation as peak and standby units for a number of years. The installation of the world's largest Diesel for peak-load service in the Hamburgische Electricitäts Werke, two years ago, was received skeptically by many, but the benefits obtained have induced the Märkische Elektricistäts Werke to install two 11,700-hp. Diesels for peak service. The engines cost $45 per kilowatt and the entire plant, including buildings, about $52 per kilowatt. The owner expects that this plant will pay for itself in five years. Considering that 3,800 B.t.u. coal is available at 60 cents per ton, while Diesel oil costs as much as 11 cents per gallon, this is quite remarkable.

In this country, while notable installations are known which serve as standby power for hydro power stations, like the 4,000-hp. Nordberg Diesel engines for the Panama Canal at Miraflores, no large Diesel engines are used as peak units in connection with steam central stations so far.

Since the central-station industry looks forward to great expansion in the near future, it seems timely, in view of the success abroad, to make a close study of the possibilities of steam-Diesel combinations under conditions that exist in this country.

Steam-Diesel Operation Affords Solution

Even including water power, it is seldom contested that large steam turbine generating stations represent the most economical production of power which is known. Several recently constructed large steam power stations are capable of producing 1 kw.-hr. with 14,000 B.t.u. or less and at a bus cost (exclusive of overhead) of less than ½ cent. To replace the largest steam stations by Diesel stations has never been proposed seriously. Though modern Diesel engines do produce 1 kw.-hr. at 10,000 B.t.u., fuel oil containing 10,000 B.t.u. seldom costs less than 0.28 cent ($1.50 per barrel), while the fuel cost of 14,000 B.t.u. in coal seldom is more than 0.21 cent (0.15 cent per million B.t.u.). This factor alone would make wholesale generation of power with Diesel engines uneconomical. Other operating and maintenance costs and fixed charges cannot even be estimated, because no Diesel units of several hundred thousand kilowatt capacity are available. The possibility of having giant power stations operated solely with Diesel engines is very remote indeed.

However, an analysis of the power costs of mixed stations, using steam turbines and boilers to supply the base load and Diesel engines to carry the peak-load and act as emergency, presents a different picture.

Basis for Analysis

The analysis covers the medium large station field only. No attempt is made to apply the findings to the giant power stations located near the east and west coasts, operating with a network of interconnections and furnishing power to highly industrial sections, although some considerations will be applicable to such great interconnected systems as well. The analysis primarily refers to the more or less isolated medium large stations, of which a great number are scattered all over the country.

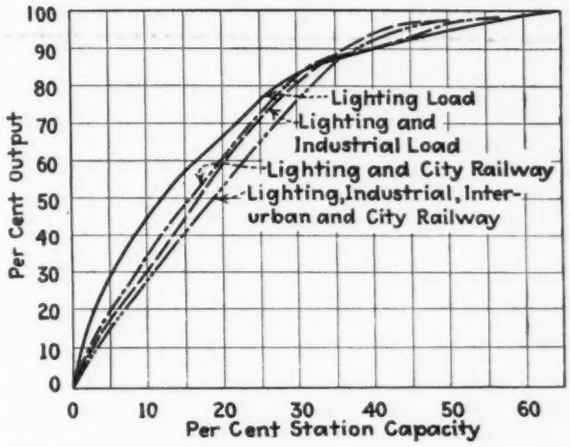
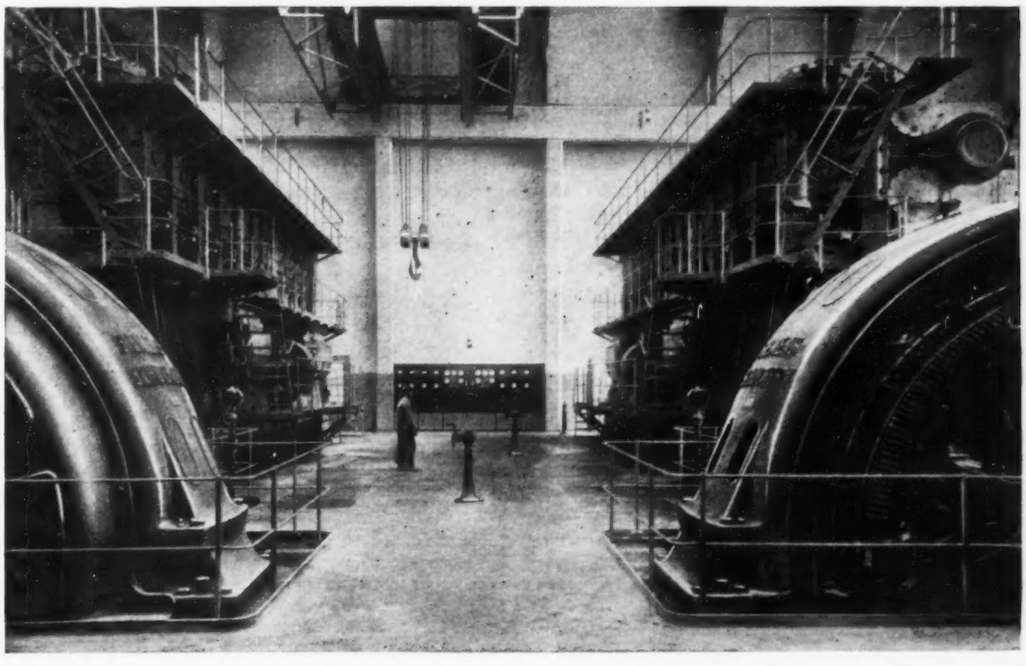


Fig. 3—Relation Between Station Output and Rating with Different Type of Load

A 20,000-kw. station has been selected for the basis of computations. The results of the analysis, however, can probably be applied to 10,000-kw. stations and 30,000-kw. stations as well, but it is not expected to hold true for stations below 5,000 or above 100,000 kw. capacity.

In order to make the analysis cover a sufficiently large territory, most of the items, like cost of installation, fixed charges, labor, lubricants, maintenance and miscellaneous items, have been typified. These items vary from one plant to the other, but none sufficiently to affect the analysis appreciably. Furthermore, the best compromise figures have been obtained from the most authentic sources.

On the other hand, such items as coal prices, oil prices and load curves cannot be typified because they vary appreciably according to locality and their bearing on the results of the analysis is very pronounced. Therefore the analysis has been extended to cover all possible coal and oil prices within the range of practicability and four different characteristic load curves have been used. The main object of the analysis is to obtain probable



Two 11,000-Hp. Diesel Engines in the Henningsdorf Peak-Load Station (Markische Elektricitäts-werke)

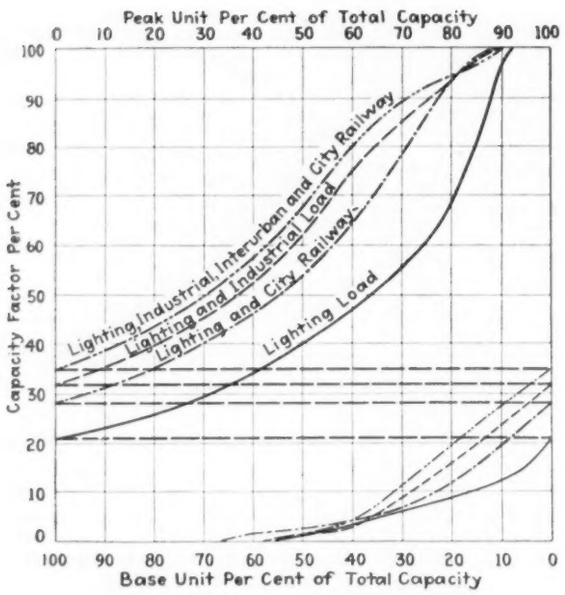

Peak Unit Per Cent of Total Capacity
0 10 20 30 40 50 60 70 80 90 100
Capacity Factor Per Cent
100 90 80 70 60 50 40 30 20 10 0
Lighting, Industrial, Interurban and City Railway
Lighting and Industrial Load
Lighting and City Railway
Lighting Load
100 90 80 70 60 50 40 30 20 10 0
Base Unit Per Cent of Total Capacity

Fig. 4—Plant Capacity Factors of Split Central Stations

Derived from Fig. 1. The four upper curves show the base-unit capacity factors and the lower group the peak-unit capacity factors for various splits.

figures on mixed station operating costs under various circumstances.

Load Curves and Station Economy

The cost of producing power depends very largely on the load characteristics. If the load is widely fluctuating, the unit cost is several times higher than it would be with uniform load. Therefore an analysis of power costs must include an analysis of the load characteristics.

Load curves of four typical American central stations, taken from the Standard Electrical Handbook, are considered. Since most large-sized central stations have industrial load and traction load in addition to lighting, load curve A, Fig. 1, referring to lighting load only, is only of comparative interest. From the daily curves a composite annual load curve was plotted made up of an equal number of winter and summer load curves for lighting load. Assuming 41 per cent excess capacity, which is an average for medium large stations, four typical load curves have been obtained. It should be noted that 95 per cent of the output can be supplied with 40 to 50 per cent of the generating capacity. The other 50 to 60 per cent of the capacity is only necessary in order to supply the other 5 per cent. This explains sufficiently why the cost of supplying the peak 5 per cent is exorbitant.

Effect of Plant Capacity Factor

As previously stated, a saving can ordinarily be effected by using special equipment to supply the peak load. The main object in using a peak unit is to increase the load factor of the base unit. In view of the fact that the base unit usually supplies more than 90 per cent of the total energy, the high efficiency of the base unit is of paramount importance.

It is well known that the dollar efficiency of steam turbine generating stations depends largely on the plant capacity factor. Therefore the plant capacity factor of the steam equipment which supplies the base load should be kept as high as possible. The peak load on the other hand may be supplied with equipment for which the effect of a lower plant capacity factor is not so significant.

The total capacity of a central station is usually split in two parts: (1) a base unit of high first cost and high economy and (2) a peak unit, of lower first cost and lower economy. But the splitting can be done in more than one way. The base unit can be made of 95 per cent capacity of the total, leaving 5 per cent for the peak unit or the split may be 90 and 10 or 85 and 15, etc. The lower the capacity of the base unit the higher will be its plant capacity factor, but then more of the

Conclusions Regarding Peak Load Economy

1. **Savings up to $180,000 a year, or 24.5 per cent of the total operating cost, can be effected in a 20,000-kw. plant by combined steam-Diesel operation.**
2. **The most economical size for the Diesel peak unit is around 40 per cent. When the annual load factor is high and the coal is cheap it is somewhat lower; when the load factor is low and the coal high it is somewhat higher.**
3. **The price of the oil is virtually irrelevant in peak-load economy. The use of 6-cent oil in place of 3-cent oil hardly affects the economy at all. The optimum size of the peak unit will be the same and the total operating costs will be virtually the same.**

   The explanation of this paradox is that the peak units furnish only a very small fraction of the total energy and it does not matter appreciably how much the fuel cost of the peak unit is.

   The conclusion is that the steam-Diesel central stations will not be affected even by a considerable rise in petroleum prices. This is the reason no curves were drawn with intermediate oil prices as 4 cents and 5 cents.
4. **The price of the coal has a pronounced effect on the combined economy. The best size for the peak unit is about 15 per cent larger using $8 coal than using $2 coal and the amount of annual saving is about five times as large.**
5. **Higher load factor coincident with more diversified load restricts the savings that can be effected with Diesel peak units only slightly. With $4 coal the corresponding savings for pure lighting load (24 per cent load factor) and diversified load (48.7 per cent load factor) are $80,000 and $62,000 respectively.**
6. **Though the most economical operation is obtained with approximately 60 per cent steam and 40 per cent Diesel, more than a proportionate amount of saving will appear with 10 or 20 per cent Diesel operation.**

   Therefore Diesels may be installed gradually.

output has to be carried by the peak unit. It depends on the load characteristics and on the type of the peak unit which split offers the best economy.

It is easy to calculate what the resulting plant capacity factors of both the base unit and the peak unit will be for a given load curve and station capacity (see Fig. 4).

The curves apply to all kinds of split central stations like water-steam, steam-steam, steam-accumulator, steam-gas, steam-Diesel stations, etc., and can be used to advantage in cost computations.

For lighting load, a 70-30 split will increase the plant capacity factor of the base unit from 21 per cent to 55 per cent compared with an unsplit station, while the corresponding increase for lighting and industrial load is from 31.5 per cent to 78 per cent. The plant capacity factors of the peak units are generally very low, but the peak units are usually of such nature that their economy is less affected by the plant capacity factor.

Comparative Unit Costs

The next step was to compute the per kilowatt operating costs for both steam operation and Diesel operation at various coal prices, oil prices and capacity factors. The total cost is considered the sum total of the following items: Fixed charges, fuel costs, lubricants, attendance, maintenance and miscellaneous items which include water, waste, supplies, etc.

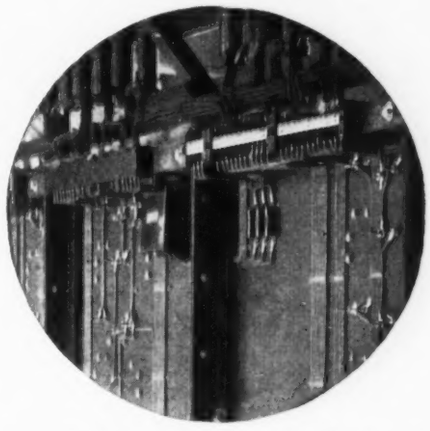
The remainder of this analysis will be presented in a later issue.

Estimating Line Costs

EXAMPLES of the practice of a Middle Western utility in the furnishing of material lists and costs for different types of line construction to local employees who may be called on to make estimates for any purpose have been shown in three lately preceding issues of the Electrical World. Herewith are presented the data on 33-kv. construction for three No. 2 conductors on 35-ft. and 30-ft. poles spaced 200 ft. To the costs given here must be added cost of right-of-way, clearing right-of-way, higher poles, if any are necessary, and any other special features. Cost figures on other constructions will appear in later issues.

Control Wiring Terminals at Top of Switchboard

ACCESSIBILITY and economy of wiring were secured in a New England generating station by locating a combustion-equipment control switchboard in the fan room and placing the terminal blocks of the various circuits at the top of the panels. Shorter runs of rigid conduit were insured in this particular case than



Rear of Panelboard for Combustion Control Equipment

with bottom-located terminal blocks; the installation speed in the field was increased on account of the height of these blocks above the floor as compared with installation at the bottoms of the panels, and the layout of wiring back of the panels was clear cut and favorable to low-cost maintenance.

Costs of 1 Mile of 33-Kv., Single-Circuit Line

With three No. 2 conductors in flat configuration on 35 and 30-ft. poles spaced 200 ft.

Material	Size	Quantity	Unit Price	Item Cost
Poles	25 ft.	1	$6.50 ea.	$6.50
Poles	40 ft.	2	16.95 ea.	33.90
Poles	45 ft.	2	18.85 ea.	37.70
Crossarms	10 ft.	34	115.00 C	39.10
Crossarm braces	No. 7953	34	80.95 C	27.52
Keystone stands and pins	No. 263	102	59.50 C	60.69
Carriage bolts	⅝x6 in.	68	3.95 C	2.69
Machine bolts	¾x12 in.	8	8.92 C	0.72
Machine bolts	¾x14 in.	26	9.50 C	2.47
Machine bolts	¾x16 in.	2	10.28 C	0.22
Machine bolts	¾x18 in.	2	12.12 C	0.24
D. A. bolts	¾x16 in.	4	13.84 C	0.55
D. A. bolts	¾x18 in.	4	14.56 C	0.58
Lag screws	½x3½ in.	45	24.99 M	1.13
Guy wire	⅜ in.	400 ft.	17.15 M	8.58
Guy clamps		12	19.79 C	2.38
Guy hooks		10	7.79 C	0.78
Strain plates		10	6.66 C	0.67
Anchor rods	¾x6 ft.	5	54.95 C	2.75
Ever-stick anchor	8 in.	5	2.00 ea.	10.00
Guy thimbles	⅜ in.	5	4.50 C	0.23
Eyebolts	¾ in. x 6 ft.	6	20.34 C	1.22
Insulators (Thomas pin type)	No. 2124	103	229.50 C	236.39
Insulators (J. D. complete)	No. A-257	6 str.	5.40 ea.	32.40
Strain insulators	No. 504	2	13.29 C	0.27
Wire MHD bare copper	No. 2	3190 lb.	20.00 C	638.00
Wire soft drawn (tie wire)	No. 6	50 lb.	20.00 C	10.00
Copper sleeves	No. 2	3	12.00 C	0.36
Ground rods	¾ in. x 5 ft.	6	66.20 C	3.97
Traffic guards	.....	1	$1.55 ea.	$1.55
Sq. washers	2¼ in.	100	15.64 M	1.57
Sq. washers	4x4x¼ in.	5	3.58 C	0.18
Total—material common to 35 and 30-ft. construction				*$1,165.31*
Add to $1,165.31 for 35-ft. pole construction.				
Poles	35 ft.	27	$12.90 C	348.30
Total—material for 35-ft. pole construction				$1,513.61
Stores department—10 per cent				151.36
Labor				388.00
Transportation and supplies				95.00
Total—material and labor				$2,147.97
General office supervision				214.80
Total—for 35 ft. pole construction				*$2,362.77*
Add to $1,165.31 for 30-ft. pole construction.				
Poles	35 ft.	2	$12.90	25.80
Poles	30 ft.	25	9.85	246.25
Total—material for 30-ft. pole construction				$1,437.36
Stores department—10 per cent				143.74
Labor				388.00
Transportation and supplies				95.00
Total—material and labor				$2,064.10
General office supervision				206.41
Total—for 30-ft. pole construction				*$2,270.51*

Large Reversing and Strip-Mill Drives

AN UNUSUAL installation of interest is the mill drive for the 36-in. reversing universal slabbing mill of the Wheeling Steel Corporation, Steubenville, Ohio. According to the A.I.E.E. committee on general power applications (J. F. Gaskill, chairman) this is the first slabbing mill installed in this country with horizontal and vertical rolls driven by reversible motors. The horizontal rolls are driven by a single armature d.c. machine rated at 7,000 hp. continuous, 50/100 r.p.m., 750 volts and capable of developing a maximum torque of 2,000,000 lb.-ft. The vertical rolls will be driven by a reversing motor rated at 1,650 hp. continuous, 112.5/270 r.p.m., 750 volts and maximum torque of 212,000 lb.-ft.

The control for this equipment is such that only two men are required in the pulpit. The speed and direction of the motors are controlled by means of a foot-operated master switch. This switch so controls the two motors that the speed ratio between the two rolls will always be maintained without any necessity for mechanical gearing.

At this same plant there is a wide strip mill installation consisting of a.-c. and d.-c. motors aggregating more than 20,000 hp.

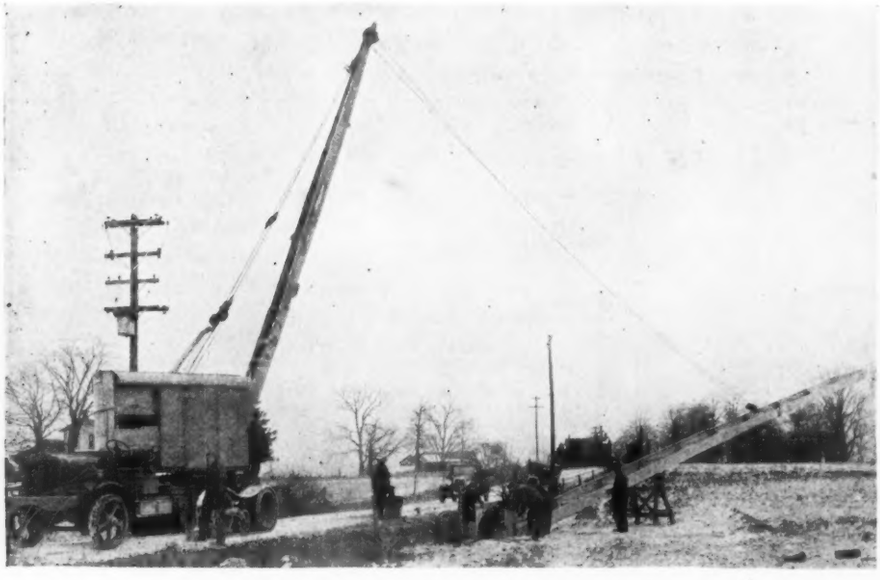
The Illinois Steel Company in its South Chicago plant has installed a 7,000-hp., 50/120 r.p.m., 750-volt, double unit reversing motor to drive a 40-in. blooming mill. Power for this motor is supplied by a flywheel motor-generator set consisting of a 5,000-hp. induction motor, a 50-ton flywheel and two 3,000-kw. generators. A 35-in. blooming mill will be driven by a single-unit, 6,500-hp., 60/140-r.p.m. motor having a similar source of power supply. This plant is also installing a 3,500-hp., 50/120-r.p.m., 750-volt d.-c. reversing motor on a 32-in. structural roughing mill and a 6,000-hp., 75/140-r.p.m., 750-volt d.-c. motor to drive a 28-in. structural finishing mill. A flywheel motor-generator with a 7,500-hp. induction motor, 50-ton flywheel and three 3,000-kw. generators will furnish power to these structural mill motors.

The new continuous hot strip mill of the American Rolling Mill Company at Middletown, Ohio, is the highest powered of any strip mill yet built. The main rolls are driven by 21,800 hp. in motors, four 3,000-hp. and three 2,000-hp. d.-c. motors on the finishing end and 3,800 hp. in induction motors on the roughing end. This mill purchases 66,000-volt power and has three 4,000-kw. motor-generator sets to supply direct current for the main roll motors.

Notable among the additions to the Sparrows Point, Md., plant of the Bethelehem Steel Combany is the use of eight synchronous motors totaling 11,750 hp. for main roll drives. This makes a total installation on main rolls of 45 synchronous motors, with an aggregate of 140,750 hp. A control has also been perfected for tying together the 6,700-hp. induction motor and the d.-c. generator supplying power to the 2,600-hp. finishing stand motor. Another new application is applied to the Mesta rotary shears. Each shear is driven by two d.-c. motors in series, enabling the shears to be run at full speed when the steel traveling at 600 ft. a minute passes through the machine. The speed of the motors synchronized with the speed of the steel enables these shears to cut the steel without an inch variation in the length of the sheets.

Portable Crane Adaptable to Various Jobs

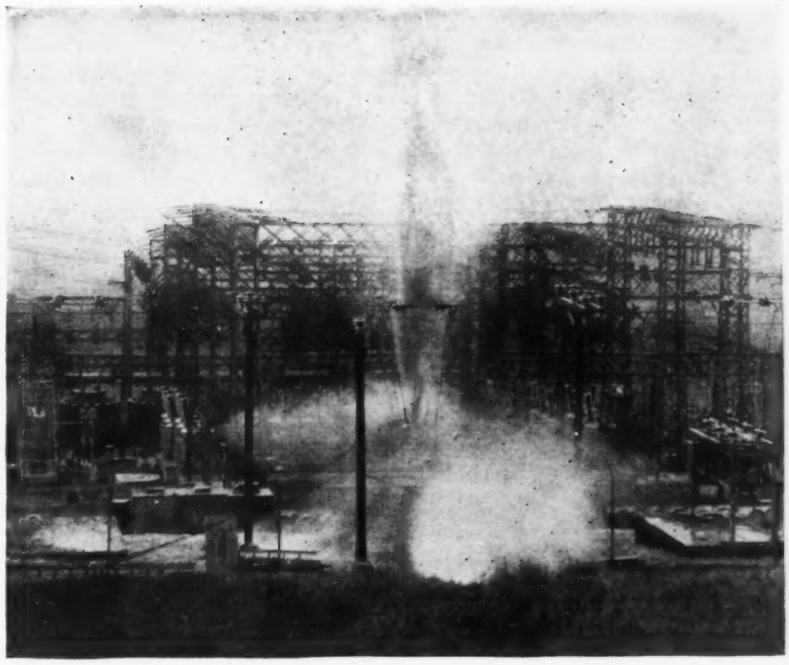
IN BACK of the crane in the smaller view below may be discerned a pear tree which the owner valued at $800 when its removal was suggested. The Dayton Power & Light Company found it cheaper to put 10-ft. extensions on the poles on each side of it; the crane may be seen doing this job without interrupting service on the line. Another job for which the crane has been used was raising 63-ft. channel poles for a 66-kv. line. The poles are hinged with bolts to the uprights set in the concrete footings. In this case the truck was fitted with extra wheels and a caterpillar track for heavy going. These tasks are only two of the variety of jobs to which the crane has been found applicable.



Truck-Mounted Crane an Economical Distribution Aid

Fire Protection

What apparatus demands it? How much should be spent?



TO WHAT extent is fire protection necessary in electrical apparatus? What apparatus needs the most protection? What measures are used now? What is the best form? What determines the expenditure warranted?

These are questions that every electrical engineer has to answer at one time or another. To secure a cross-section of the opinion on this subject eight prominent engineers were consulted.

As one engineer says:

"The best fire protection practice indoors is to install oil-insulated transformers and regulators in fireproof rooms, which can be closed in times of trouble and protected by some kind of a gas system similar to the so-called 'lux' system. In the case of large, expensive rotating apparatus, such as turbo-generators, frequency-changer sets and synchronous condensers, that have their frames built tight enough so that the air dampers can be closed in emergency, they should be protected either by perforated water pipes installed inside the frames or by some non-inflammable gas, such as the 'lux' system. My preference is for the gas."

Extent to Which Protection Is Necessary.—One engineer says that all major apparatus should be fully protected, as damage by fire is usually expensive and also causes interruptions to service. This statement is qualified by three other engineers, one of whom says the extent of protection depends on the probable cost of repairs and the risk and seriousness of interruptions to service. Careful analysis should be made in each case, warns another engineer, in order that use of fire-fighting equipment may not prove more hazardous than the fire. Hazards to other equipment must also be taken into account.

In studying the need for fire protection, points out still another engineer, two classes of damage must be considered—direct and indirect. Apparatus which is very expensive, which is unusually susceptible to fire damage or which individually is very essential to service should be protected from fire damage. Consideration should also be given to the probability of any fire damaging other important equipment provided that the congregation of susceptible apparatus is extensive or of large aggregate value, or provided that service is endangered.

Apparatus That Needs Most Protection.—Modern station buildings are fireproof and usually the only apparatus which would cause a fire of any magnitude is that containing oil, points out one engineer. Therefore, protection is needed primarily for oil-filled equipment such as transformers, regulators and oil circuit breakers. Small fires may result in insulation failures on wires, he adds, and machine windings sometimes cause fires within the equipment, but these are not very extensive. Two engineers insist there is no choice, if the apparatus contains oil or considerable fibrous insulation which will burn. Still another declares that air-cooled synchronous machinery of large capacity, connected to circuits in which high-voltage transients may originate, demands protection most. Aside from emphasizing the need of protecting against fires from equipment containing considerable oil, the other engineers consulted call attention to the need of protecting rotating equipment such as generators, synchronous condensers and motor-generators.

Protective Measures Used in Eight Systems—Methods of guarding against fires and limiting damage differ. Among precautions taken by the eight companies consulted are: Steam, water or CO_2 connections with manual or automatic control; recirculating ventilating air continuously or temporarily; fire-resistive cells or group compartments; isolation by separation outdoors; crushed rock or cinders to absorb oil and quench fire outdoors; use of "foamite," "pyrene," carbon tetrachloride, sand.

Not all these precautions are necessarily used by each company. For example, one company reports use of steam connections to generators, two water connections, three CO_2 connections, one recirculation of air, fire-resistive cells and outdoor isolation (although others are known to use these methods), one crushed rock, three "foamite," one "pyrene," two carbon tetrachloride, one CO_2 portable extenguishers, two sand, two unidentified portable equipment. One of the companies declares that "foamite" is probably the most effective for oil fires, and that small fires, such as switchboard wiring, are extinguished by carbon tetrachloride or carbon dioxide. CO_2 gas is injected by one company into inclosed machinery, compartments or individual pieces of apparatus.

> ***Insurance of continuity of service might in individual cases justify an expenditure for fire equipment in excess of the investment protected.***

Opinions on Best Fire Protection.—Again opinions

vary, CO_2 connections being favored by two, where air is confined; recirculation of ventilating medium by two, fire-resistive cells or rooms by four (although others infer this method), outdoor isolation by two, crushed rock by one, "foamite" by three, "pyrene" by one, carbon tetrachloride by one, portable CO_2 extinguishers by two, sand by one and unidentified portable extinguishers by two. "Foamite" is recommended by one for oil fires, and for outdoor fires by another.

Protection of oil circuit breakers will be influenced by the amount of equipment involved, the amount of oil in use, the segregation of oil tanks, tightness of inclosures, complications due to piping and automatic equipment.

Although only one engineer pointed it out, others doubtless agree, by their practices, that providing differential relay protection on generators and transformers is a protection against fires of the preventive rather than remedial character.

Expenditure Warranted.—Experience is too limited to serve as the determining factor in deciding upon fire protection, declares one engineer, because of rapid changes in design of electrical apparatus. It is the consensus of opinion that the expenditure for fire protection must be decided in each individual case by the risk involved, the cost of the equipment and the cost of interrupted service. However, one engineer claims that expensive fire-protective equipment does not appear warranted, and that portable fire apparatus in proportion to the fire hazard is relatively inexpensive.

Considered more in detail, says one engineer, the problem involves determination of

(a) Money value of apparatus involved.
(b) Importance of service rendered by apparatus involved.
(c) Probability of incidence of fire.
(d) Probability of spread of fire.
(e) Probable physical damage.
(f) Probable hazard to human life.
(g) Cost of insurance to reimburse monetary loss.

As one engineer points out, insurance of continuity of service might in individual cases justify an expenditure for fire equipment in excess of the material protected.

Automatic Gate Control Maintains Normal River Flow

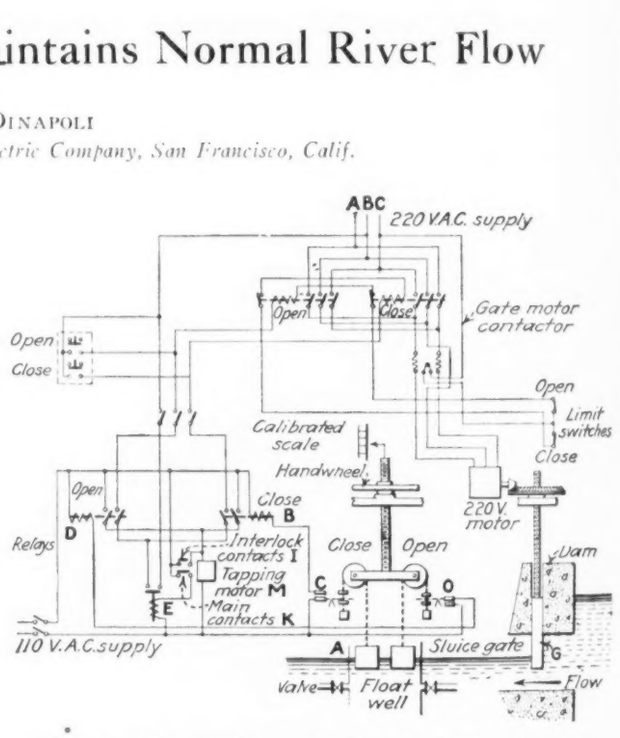
By D. P. Dinapoli

Assistant Engineer Pacific Gas & Electric Company, San Francisco, Calif.

IN MANY hydro-electric projects of the West it is necessary for the power company to provide some means for regulating stream flow below a power plant to maintain normal flow in order to satisfy rights of irrigation districts which later use the water. In some instances this has necessitated construction of an afterbay with sluicegates and either hand or automatic regulation. On the Pit River development of the Pacific Gas & Electric Company the diversion dam for Pit No. 4 power house, not yet constructed, is being utilized as a regulating reservoir by means of automatically controlled sluicegates. Gate operation must fulfill two requirements: First, to maintain a given river flow and, second, to vary the flow to follow slight seasonal variations which accompany the normal river flow.

A device for this purpose, as shown in the accompanying diagram, consists of three main elements, namely, the float mechanism, the relays and the sluicegate with its motor and contactor. The float mechanism is installed in a float well located in a calibrated part of the stream which is about 140 ft. below the sluicegates. The change in water level between a flow of 1,600 sec.-ft. and 3,000 sec.-ft. at this point is approximately 2 ft. The float mechanism consists of two sensitive type, single-pole float switches with an approximate travel of the operating lever between the opening and closing position of $\frac{1}{2}$ in. These two floats are mounted on a yoke so that they may be raised or lowered by means of a hand wheel and screw to secure a level corresponding to any flow to be maintained. Relative positions of screw and scale indicate the flow.

Future experience may point to the desirability of controlling the flow to be maintained in the river from the power house or some other remote point. This may easily be done by installing a small motor to drive the level regulating handwheel, this motor being controlled by position indicator equipment so that the position of the floats will correspond to the level set at the indicator of the remote station.



Automatic Sluicegate Control Equipment

Any change in water level causes either switch *C* or *O* to close, energizing relay *B* or *D*, thus energizing tapping motor *M*, closing main contacts *K* and energizing relay *E*. This relay closes the circuit to the gate motor contactor and the gate opens or closes, depending upon which float switch, relay and contactor have functioned. The operating mechanism of the tapping motor consists of a Warren motor, two sets of contacts and a cam with four risers. The cam which actuates the contact is driven by the motor at a rate of 1 r.p.m., making four contacts a minute of the tapping motor. Opening of the main contacts *K* of the tapping motor de-energizes relay *E*, opening the motor contactor. As long as either float switch *C* or *O* remains closed the sluicegate moves by increments every 15 seconds until the predetermined water level has been restored.

Electric Utility Training for College Men

By James C. Clark
Professor of Electrical Engineering, University of Arizona

The scope, aims and attendance of eighteen utility courses and the selection, pay, turnover and advancement of the employee-students are analyzed by an educator

For about twenty years a few of the larger electric utility companies have maintained training courses for college graduates. During this period many more have come into existence. Within the last two or three years some half-dozen new courses have been started. Increasing interest in the matter is manifested in several ways by the more alert executives. Greater care is shown in the selection of the entering graduates; closer supervision is given the activities of the men during the courses; reorganization of some courses has taken place, using experience as a guide toward their betterment. College students, professors and personnel officers are eager to know the characteristics of various courses and the means by which students can be placed in employment, with opportunities for advancement materially satisfactory to students and employers.

In the development of training courses there have come about some rather striking differences among them in respect to certain salient features, such as length of course, current number of men in training in companies of similar size, rate of pay and conduct of classes on company time. Data have not been obtained from all the electric utilities conducting training courses—the writer knows of no complete list, even, of such utilities—but it is thought that this survey, comprising eighteen companies, covers at least a majority of them. The data given in the accompanying table are probably representative of American practice in the matter.

Purposes of Courses

Student training courses are also maintained by the larger electrical manufacturing companies. In two such organizations several hundred young men are employed on the course; numbers vastly greater than any central station company employs. It may be pointed out that, urgent as their needs may be for recruiting their permanent organizations with the graduates from their courses, the manufacturing companies are not greatly concerned over losing a large fraction of the men who complete the courses. Even though 30 or 40 per cent may leave the employ of the company on, or soon after, the conclusion of the nominal training period, it is felt that wherever the young men find employment they are actively or potentially good friends of the manufacturers who made sacrifices to train them. On the other hand, if any considerable percentage of men left a utility's training course for employment elsewhere, it would properly be regarded by the utility as indicative of serious failure somewhere in the conduct of the course, or in selling the company to the students. Fortunately, with very few exceptions, the percentage of students leaving the utility companies without having given the "regular jobs" a fair try is so low as to be almost, if not quite, negligible.

In a broad way, the object of the typical course is to train students for responsible positions in the organization. It was, of course, to develop capable human material for such positions that they came into existence. Training of non-college men could not proceed fast enough to meet the needs of most of the rapidly expanding utilities, even though such men had been of adequate caliber for the executive positions, which was not always the case. It is generally conceded that young men of college training are more capable of learning new duties rapidly and thoroughly than men who are without such mental and social training and experience.

Nearly all the courses are arranged to give the student experience in all phases of the business. He is transferred on a more or less definite schedule from one department to another. In this way an intelligent and inquisitive student has only himself to blame if, at the end of his course, he has not attained two very important objectives, namely, a fairly intimate knowledge of the business as a whole and a definite idea as to the kind of work in the organization for which he is best fitted. Naturally, it is not expected that a student can obtain thorough mastery of the detailed work of a department in which he may spend only a month in a course lasting only a year's time, or less. However, he can surely grasp the significance of the work of that department in his limited stay, and he can understand the relationships of the department to all the others in the structure of the company. Moreover, as he goes on in his course, nearer and nearer to its completion, he gains an increasingly clearer vision of these matters. Doubtless none of the courses fails to provide the student with experience in a sufficiently wide variety of work to enable him to decide with confidence where he belongs in the organization.

The aim of nearly all the training courses is to develop men for every phase of the utility business. There are exceptions to this, however. One large and successful Western company conducts a course only for the commercial department, stating that it can never find enough suitable applicants having good selling characteristics, whereas its supply of trained engineering help is so large that it finds no need of training college men for engineering. No data from this company have been used in this study.

The period most used for the courses is twelve months.

However, there are, as shown in the table, courses of a strikingly wide variety of lengths, as follows:

1 to 6 months	6 to 12 months	2 to 24 months
1 to 9 months	1 to 18 months	1 to 30 months
1 to 10 months	1 to 21 months	2 to 36 months

There are also two courses of indefinite length, one of 24 to 30 months and one (a new one) stated by the company to be "indefinite." This latter course is believed to be one of the longer courses. Nearly all of the twelve-month courses are conducted by larger companies with much experience in the training of men, but this is also true of both the two two-year and one of the three-year courses.

It is not at all clear what is the best length for these courses. Presumably the young man will favor a

Company Views of Utility Training Courses

Course No.	Conditions of Admission: College Graduation Necessary	Courses from Which Graduates Are Taken	Scholarship: Important	Scholarship: What Upper Fraction of Class Considered	Personal Interview Indispensable	Previous Employment Advantageous to Applicant
East						
1	Yes	E.E., M.E.	Yes	Not rigid	No†	No
2	Yes	E.E., M.E.	Yes	Not given	No	Yes
3	Yes	E.E., M.E., principally	[3]	½	Yes	Yes*
4	Yes	E.E., M.E.	Yes	½	Yes	Perhaps
South						
5	Yes	E.E., M.E., Some others	Yes	½	No	Yes
Mid-West						
6	Yes	E.E., M.E., A few C.E., Econ., Comm	Yes	½	No	Yes
7	No	E.E., M.E., C.E., Chem. E	Yes	Not given	Yes	No
8	Yes	E.E., M.E., C.E.	Yes	½	Yes	Yes
9[1]	Yes	E.E., M.E.	No		Yes	Perhaps
10[2]	Yes	E.E., M.E., C.E.	Yes	½	Yes	Perhaps
11	Yes	E.E., M.E.	Yes	[5]	Yes	Yes
12	Yes	E.E.	Yes	½	Yes	Yes
West						
13	Yes	E.E., M.E., C.E., Gen. E., Chem., E.	Yes	½	No†	Yes
14	Yes	E.E., M.E., C.E.	[4]	Not given	Yes	Yes
15	Yes	E.E.	Yes	Not given	Yes	Perhaps
16	Yes	E.E., M.E., C.E., Econ.	Yes	½	Yes	Yes
17	Yes	E.E.	Yes	½	No	Yes
18	No	E.E., M.E., C.E.	Yes	Not given	Yes	No

Course No.	Attendance: Usual Number Applicants per Year	Number Accepted per Year	Number of Men Now on Course	Per Cent of Men Who Remain with Company at Completion of Course	Per Cent Still with Company of All Men Who Have Taken Course	Usual Number of Men Dropping Out of Course per Year
East						
1	Not given	8	15	Not given	83	1
2	300	10	10	90	80	10%
3	[6]	[6]	30	100	[6]	0
4	250-275	16	36	70	80	3
South						
5	100	15	22	100	96	3
Midwest						
6	400	50-100	75	95	[9]	Less than 5%
7	40-50	8-10	8	75	40	6-8
8	200	20	11	100	93	1
9[1]	20	6	12	75	50	2
10[2]	20	10	17	100	100	0
11	5	4	4	100	74	0
12	60	4-12	4	100	91	0
West						
13	200-300	15	11	100	88[10]	Negligible
14	18	5	5	Not given[7]	Not given[7]	Not given[7]
15	25	4-6	10	Not given[8]	Not given[8]	1
16	Not given	12	12	90	90	Negligible
17	Not given	3	1	100	Not given	Negligible
18	Not given[7]	Not given[7]	5	Not given[7]	Not given[7]	Not given[7]

Course No.	Compensation: Length of Course (Months)	Monthly Pay During Course by Periods	Probable Monthly Pay in First Company Position Following Course
East			
1	24-30	$113 at start; $8 increase at four months, eight months, twelve months, eighteen months, twenty-four months after start	$210
2	12	$125 throughout	150
3	[11]	$140 first 6 mos., $160 second 6 mos., etc.	Not given
4	36	$125 first 6 mos., $150 second 6 mos., etc.	$250
South			
5	24	$100 first 6 mos., $110 second 6 mos., etc.	$130
Midwest			
6	12	$120 first 6 mos., $130 second 6 mos.	$150
7	21	$125 throughout	$150-$175
8	6	$125 at start[12]	$145
9[1]	30	$125 at start[12]	[15]
10[2]	12	$125 at start[12]	[15]
11	12	[12]	$140
12	9	$100 first 4 mos., $110 second 4 mos., etc.	$125
West			
13	24	$100 at start, $5 increase each 4 mos.	$135-$145
14	10	$100 throughout	$140
15	36	$100 first 6 mos[14]	$150-$175
16	12	$115 first 6 mos., $125 second 6 mos.	$125-$150
17	18	$100 first 6 mos., $110 second 6 mos., etc.	$125-$150
18	12	$125 throughout	Not given[7]

Course No.	Opportunities: Classes or Lectures Provided on Company Time	Hours per Week for Classes, etc., on Company Time	Opportunities‡ for Evening Study in Community	Recreational‡ Advantages of Community
East				
1	No		Exc.	Fair
2	Yes	One-half day through six months	Exc.	Good
3	No		Exc.	Exc.
4	No		Exc.	Good
South				
5	No		Fair	Fair
Midwest				
6	Yes	One-half day first three months, two half-days last nine months	Exc.	Exc.
7	Yes	One hour throughout course	Good	Exc.
8	No		Exc.	Exc.
9[1]	No		Exc.	Exc.
10[2]	No		Exc.	Exc.
11	Yes	One-half day throughout course	Exc.	Exc.
12	No		Exc.	Exc.
West				
13	No		Exc.	Exc.
14	Yes	Four hours throughout course	Exc.	Exc.
15	No		Exc.	Exc.
16	No		Exc.	Exc.
17	No		[16]	Exc.
18	No		Exc.	Exc.

[1] A course training for power plant operation.
[2] A course training for design and engineering.
[3] "Not especially."
[4] "Not all-important."
[5] This depends upon the work: upper ¼ for some positions; lower for others.
[6] Reorganized course not yet in existence one year.
[7] New course, inaugurated this year.
[8] New course, first class not yet through.
[9] 1914 to date, 71 per cent; 1922 to date, 83 per cent.
[10] Based on 1923 to date.
[11] Course of indefinite length.
[12] No set rate of increase.
[13] $105 at start; $5 increase each two months; $125 last four months.
[14] Advances depend upon a rating scheme.
[15] "Depends on the man."
[16] Reported as "up to student."
*Previous employment by the company was formerly required for admission to the course.
†Desirable.
‡Rated as excellent, good, fair, or poor by company representative.

twelve-months course, or possibly even a shorter one. Such a course will afford a month's time in each of eight or ten important departments and periods of two weeks in several different places of lesser importance. Whether enough knowledge of important work can be gained in a month by an intelligent young man is a question that the writer cannot attempt to answer. However, it seems certain that not less than a year should be spent on the course as a whole, when it must be divided among so many varieties of work as are afforded by the modern electric utility.

Selection of Applicants

From the correspondence attending the collection of the data, it seems a very apparent tendency, among those having much experience in the conduct of the courses, to make a most careful selection of the candidates for places, eliminating all who entertain the least doubt that they wish to remain permanently with the company. Care in selection has been carried to the point where it has resulted in most of the companies having a very small group in training at any time.

That the policy of careful selection of men is successful seems to be borne out by the very small numbers who drop out per year, even when those are included who withdraw for miscellaneous reasons, such as illness. Most companies report a large percentage of men remaining with the company after finishing the course, and, where data are available on all men who have taken the course, a surprisingly large percentage of them have stayed on with the company, in most cases.

Scholarship is considered important by most of the companies, and a common requirement is that the applicant be in the upper half of his class. Several companies have taken pains to point out, however, that "scholarship is not everything." Personality is rated highly by those who take the trouble to mention it. It goes without saying that good character is essential.

Rates of Pay

It is gratifying to note that several important companies are paying $125 to the men at the start. It seems unlikely that those companies which pay only $100 will secure the type of student that will benefit greatly by his course and become a loyal and productive permanent member of the organization. To conduct such courses is expensive in many other ways than in the mere salaries paid to the student. If $125, or even $150, per month will facilitate a better selection of men, is not the extra money well spent?

Classes on Company Time

It is rather disappointing that so few companies conduct regular class exercises on company time. It is recognized, of course, that this is not always feasible when the students are scattered over large areas served by the company. Yet, this seems a most effective method, not only for instruction in technical or commercial methods of an organization, but for instilling group spirit into the students and for inspiring them with enthusiasm for the organization.

Published Company Information

Company publications about their training courses are not always all that could be desired. In fact, some companies apparently have no published information, even in mimeographed form, ready to send out. On the other hand, some of the more elaborate booklets as to text, illustration and printing are decidedly inferior to the simpler terse, mimeographed letter-size sheets that certain companies have issued.

An Outstanding Course

Some features, as given below, of the course conducted by one large Western company are so excellent that they seem to warrant special consideration by those executives seeking for ways of improving their courses:

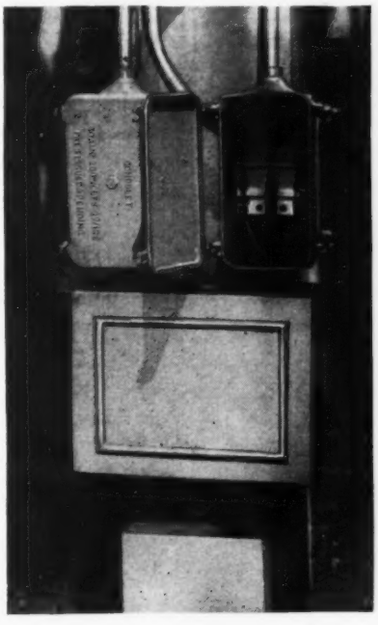
1. In seven compact mimeographed "Instruction Letters," each numbered and dated, all students are given every item of information concerning the objects, nature and conduct of the course. No reasonable question is left unanswered. All seven letters occupy only eight 8½x11-in. sheets, two sheets being given to the important introductory Letter No. 1.
2. The objects and advantages of the course are clearly and briefly explained to the student.
3. Twelve men, only, are constantly on the course, and one new man is started at the beginning of each calendar month throughout the year.
4. At the start of his course, every student is introduced to the company officials and department heads. He is given an oral history of the company
5. A schedule of work for the twelve months is laid out in advance. This is perfectly definite as to the nature of the work and its location.

Conclusion

Although the conditions under which the various utilities operate doubtless demand some variety in the manner of conduct of student training courses, the data presented here show some remarkably large differences in practice among the companies. Are these differences all warranted? While there is certainly no occasion for standardization in such features of the courses as duration, salaries, class exercises, etc., yet it seems that substantial improvement may be made in some quarters through study of the best courses.

The writer will continue this study and will welcome the co-operation of interested persons.

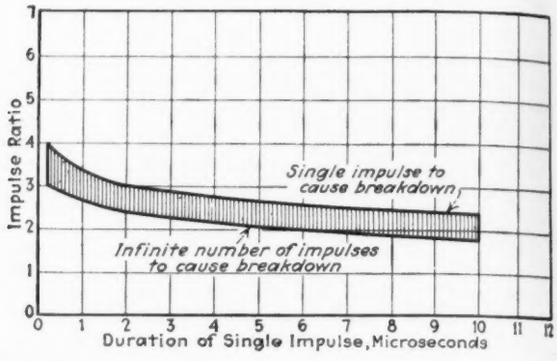
Isolating Potential Transformers



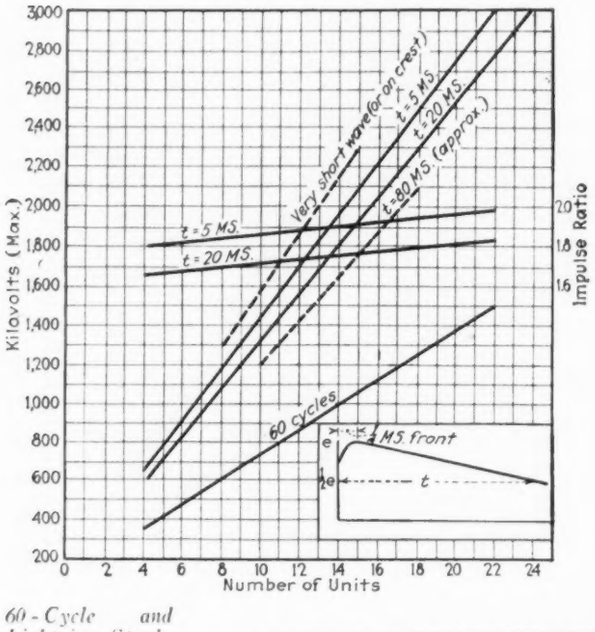
TO PREVENT "back-up" shocks in working on potential transformers mounted outdoors in a substation yard somewhat removed from the switchboard a Massachusetts utility employs terminal and switch boxes in the potential transformer secondary circuits by which complete isolation may easily be obtained for the field equipment. These boxes are mounted on the steelwork of the outdoor substation buses and allied equipment, so that it is only the work of a moment to segregate any potential transformer from possible live wiring in the station as well as outside.

Manifestation o

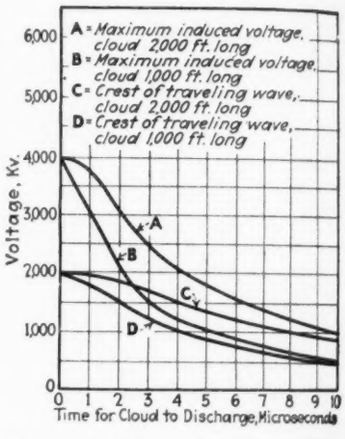
SCIENCE is unfolding the mysteries of lightning. As more of its specific characteristics become known, additional means of guarding against its ravages can be developed.


Impulse Ratio
Single impulse to cause breakdown
Infinite number of impulses to cause breakdown
Duration of Single Impulse, Microseconds

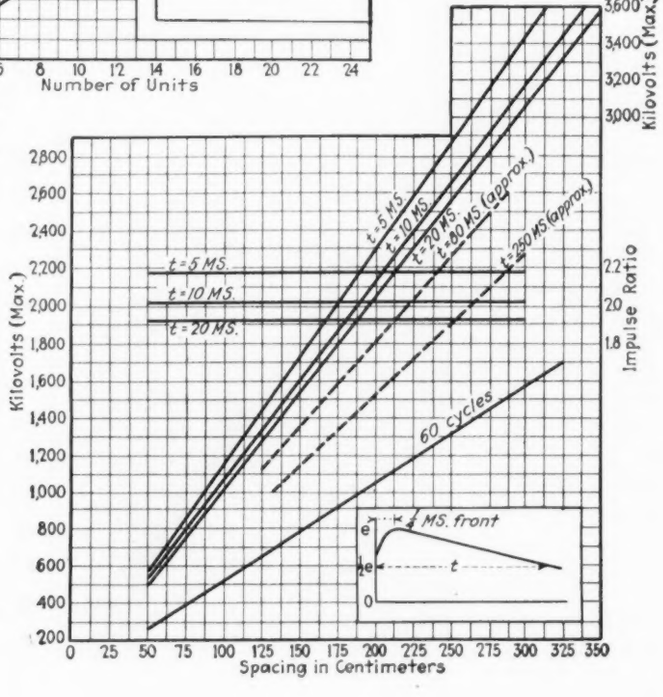
Impulse Ratio and Cumulative Effect of Impulses. Shaded Portion Shows Area in Which Deterioration Takes Place



60-Cycle and Lightning Spark-over Curves of Suspension Insulators for Different Waves


A = Maximum induced voltage, cloud 2,000 ft. long
B = Maximum induced voltage, cloud 1,000 ft. long
C = Crest of traveling wave, cloud 2,000 ft. long
D = Crest of traveling wave, cloud 1,000 ft. long
Voltage, Kv.
Time for Cloud to Discharge, Microseconds

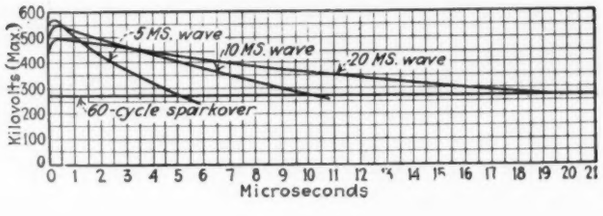
Maximum Voltage Induced in Conductor 40 Ft. High for Various Cloud Discharges

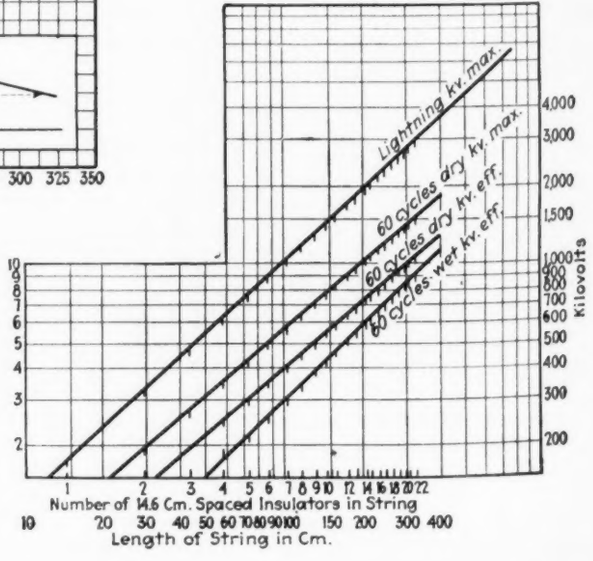


Point Gap Spark-over for Different Waves

Lightning and 60-Cycle Spark-over for Standard Diameter Suspension Insulators. Wave Reaches Crest in ½ Microsecond and Decreases to 50 per Cent in 5 Microseconds

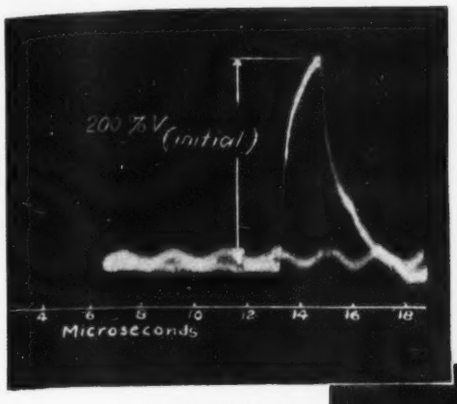
Spark-over of 50-Cm. Point Gap for 5, 10 and 20 Microsecond Waves



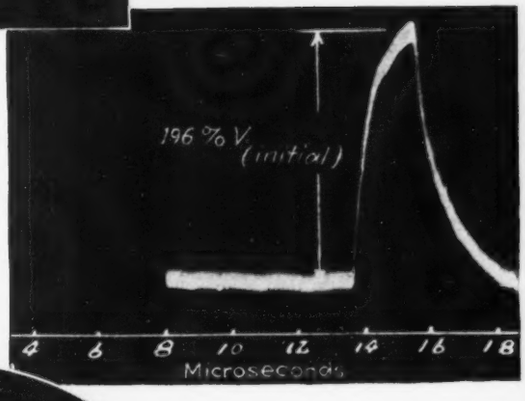

Lightning kv. max.
60 cycles dry kv. max.
60 cycles dry kv. eff.
60 cycles wet kv. eff.
Kilovolts
Number of 14.6 Cm. Spaced Insulators in String
Length of String in Cm.

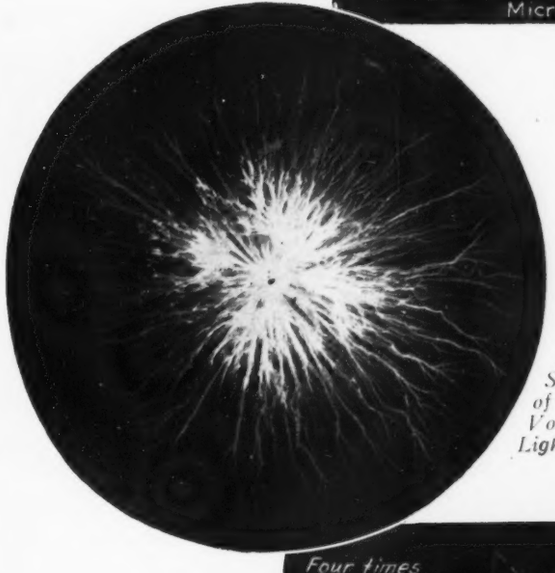
# of Lightning

The accompanying records come from the laboratory of F. W. Peek, Jr.

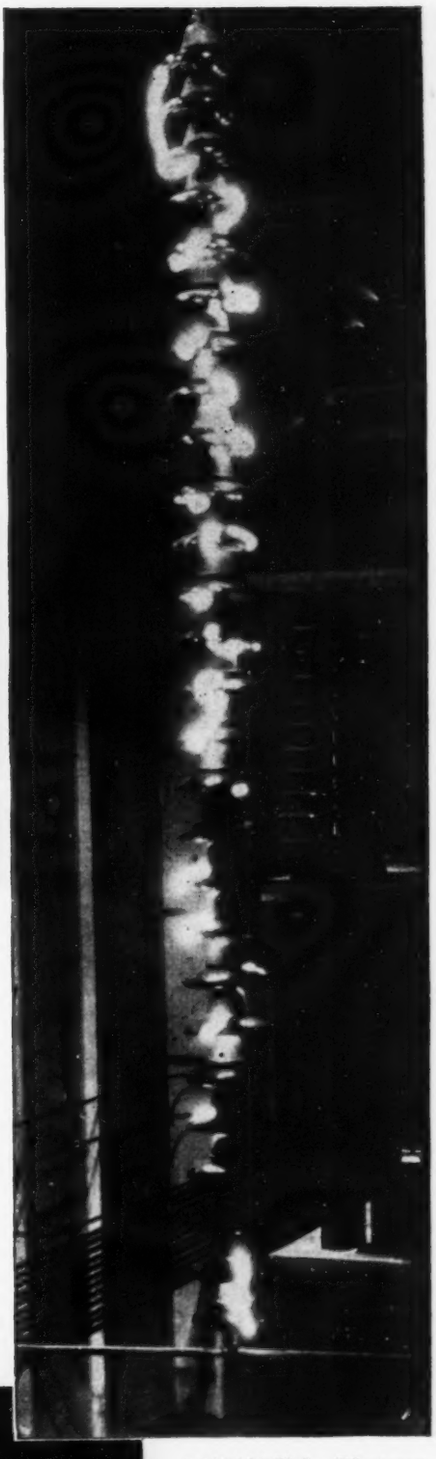


Similar Waves Striking Open End of Line and a Transformer

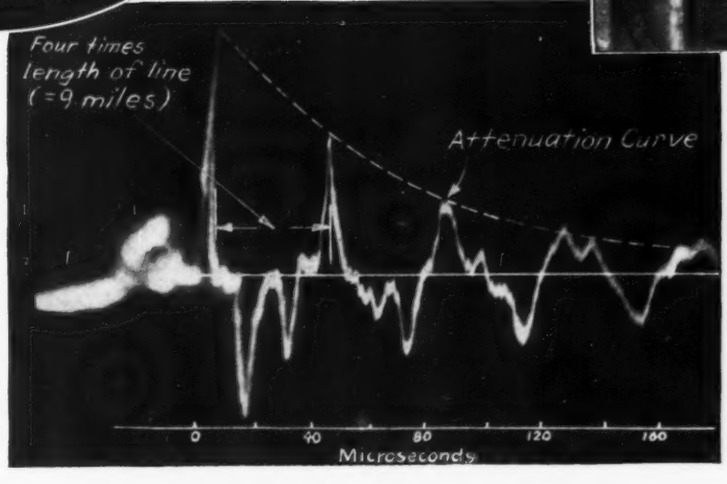




Surge Record of 5,000,000-Volt Artificial Lightning



5,000,000-Volt Discharge Across 27-Unit String of Suspension Insulators

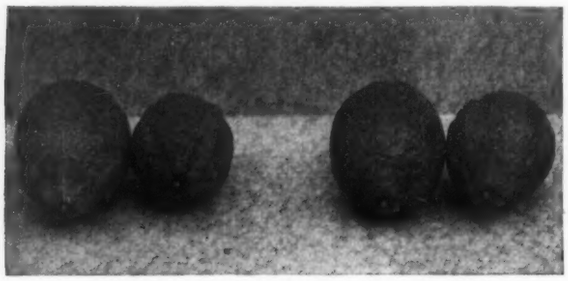


Attenuation of Lightning Surge Subjected to Successive Reflections from Opposite Ends of Line

Electrical Fruit Processing Offers New Power Load

By E. J. Sipperly
Industrial Heating Specialist, General Electric Company, Los Angeles, Calif.

FROM the earliest days of the citrus fruit industry the problem of preventing loss through blue-mold decay has been recognized as of vital importance. No adequate remedy for blue-mold decay was discovered until very recently, when the borax method of treatment



Electric Process Prevents Decay of Lemons
In each group left, treated; right, untreated

(Brogdite), making use of electric heat, became available to the citrus industry.

In connection with the Brogdex system, approximately 1,000 kw. is now being installed in fifteen electrically heated "Brogdexers" in packing houses in California. This system installed in packing houses consists of two distinct phases.

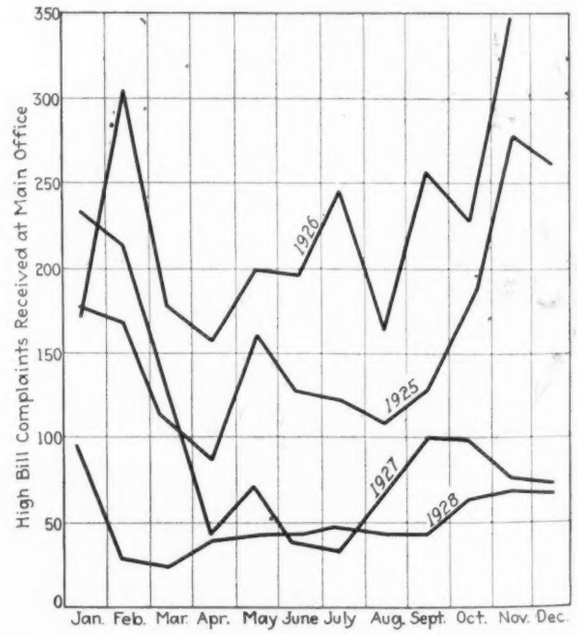
When the fruit is delivered to the packing house it is sterilized as a precaution against decay. As the fruit passes through the washer a mild solution of borax thoroughly sterilizes and cleanses each piece of fruit, thus effectively preventing the development of mold decay, even in citrus fruits, which have been positively injured and innoculated with blue-mold spores. After thus being sterilized, the fruit is dried and then passed through the fog chamber, in which the fruit has its pores invisibly sealed by a harmless fog of paraffin. It is in this machine that the electric heat is used. The eye cannot detect the presence of the fog on the fruit, so delicately is the process adjusted, and it is for this reason that electric heat was adopted. This coating prevents the fruit from aging and shrinking, keeps it plump and firm, cuts down icing costs and enables the shipper or buyer to keep the fruit in fresh condition. When the fruit leaves the fog chamber, which consists of the paraffin fog, it is then polished by means of special brushes at a temperature of 200 deg. F., so that its natural sheen and attractive color are enhanced and maintained to the hands of the consumers.

There are now approximately 75 plants in operation in the citrus fruit houses and 50 plants processing apples. In California there are 225 citrus packing plants which will eventually be equipped and, when considering the total apple houses and those citrus plants in other states, there are approximately 500 plants in all, and there is little doubt but that all will be equipped with this system. Using a conservative figure of 400 houses equipped with this system, a connected load of 20,000 kw. is expected for electric heat and 2,000 hp. for motors, giving an annual consumption of 35,000,000 kw.-hr., and by using a figure of $16 annual revenue per kilowatt connected, instead of $40, a figure used for industrial heating calculations, a revenue of $320,000 per year is evidenced. This is less than 1 cent per kilowatt-hour and if packing houses average approximately 0.014 cent per kilowatt-hour, the total, at this figure, is $453,000 per year.

Orders already secured represent about one-twentieth of the ultimate, which will amount to $90,000, and the necessary electrical equipment, such as transformers to be furnished by utilities, and switches, conduit and wiring, to be furnished by contractors, will add to this amount approximately $190,000, or a grand total of $280,000.

"D.R." Plan Cuts Complaints

A STRIKING reduction in the number of high bill complaints received at the main office of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I., has occurred since the introduction of the district representative system on that property at the beginning of 1927. The work of these representatives includes meter reading and bill collecting when arrears have arisen, sales activities, adjustments of service difficulties, and other duties, and each man devotes his attention to about 1,000 customers. In the two years prior to the introduction of this system the peak periods of complaint were in the winter and fall. It is noteworthy that within three months after the "D.R." system was adopted the number



Customers Turn to District Representatives for Bill Adjustments

of main office complaints on the score of high bills fell below the total for any previous month in the period covered by the chart, returned to the previous minimum once and has since run consistently below the corresponding month for the previous year with trifling exceptions. The present level of the complaint line is from one-third to one-fifth the previous average.

Blue Sky Regulation and Public Utility Securities

By GEORGE C. MATHEWS*
Statistical and Securities Department, Wisconsin Railroad Commission

INDUSTRIES ***such as electric utilities, whose annual requirements for additional capital are measured in billions of dollars and which are constantly expanding, cannot fail to be concerned with the exercise of governmental control over the marketing of their stocks and bonds.***

To assure the flow of capital to meet the imperative needs of the industry is one of the primary obligations of its management. If the policy of the states, or ultimately of the nation, should be to impose restrictions which are well within the range of possibility, the power of utilities to command capital may be seriously impaired. It is no exaggeration to say, declares the author, that if better standards of security marketing are not provided, no matter by whom, the ultimate result may be injurious to utility credit.

WHAT relationship is there between blue sky regulation and utility securities? The essential feature of blue sky legislation is the intent to prevent fraud and unfair practices. It is not the function of such legislation to protect the purchaser against such danger of loss as may be inherent in the security he buys. Neither is such legislation designed to prevent the purchaser from speculating if he desires to do so. It is designed to assure, as far as its administration can accomplish the purpose, that the buyer of securities is not misled as to the real nature of what he buys, that when he is buying speculative securities he be sufficiently advised of that fact, and that he have in return for the risk which he assumes a fair chance for speculative profit. Not all utility securities meet the standards of blue sky legislation and sales methods range all the way from those of the highest standard, down through those which merely fail to give information which the prospective purchaser ought to have, to those which mislead by the use of fictitious valuations and improper statements of earnings.

From the standpoint of blue sky law administration the objectionable sales practices appear to be matters of general sales policy, much harder to eradicate or control than the individual acts of overzealous salesmen. Some of these objectionable practices stop well short of the point where they could be held to be fraudulent or legally unfair. The securities commission of course can prohibit only such practices as a court would hold to constitute misrepresentative or misleading. Much of the information distributed on security issues may mislead the average investor, though not reaching the point where an order of a securities commission refusing to permit its use could be enforced in court.

The public service securities committee of the Investment Bankers' Association seems to have recognized this situation and has formulated general standards regarding circulars on utility issues which, it may be assumed, reflect the opinions of members of the committee as to the nature of the information which should be given. If we note the extent to which circulars used by its members fail to disclose the information recommended by its committee it is easy to understand why the published proceedings of the conventions of the association should contain a disclaimer of responsibility for or acceptance of opinions therein expressed.

The 1928 committee recommended that financial circulars should contain information regarding the valuation of the property and the basis of the valuation, but of the 41 circulars chosen at random and analyzed twenty-eight were silent as to the valuation of the property. Less than a third of the circulars gave any information as to property values, and of these two merely stated that the value was largely or substantially in excess of the funded debt. Thirteen circulars which gave information as to valuation gave the name of the appraiser, and the list included some appraisers whose results we have found, in our own work of public utility regulation, to be so extreme that they could not be given any consideration whatever and could not be supported either by the cost of reproducing the property or by its commercial possibilities.

EXAGGERATIONS DO HARM

It would be most unfair to leave the impression that the appraisals used are generally subject to this criticism, but the use of exaggerated values in some instances tends to cast doubt upon the correctness of values stated in other cases. With over two-thirds of the circulars making no showing as to values, the methods of selling utility securities seem to fall far short of compliance with the recommendation of the committee. Although satisfactory earnings are of vital importance to purchasers of utility securities, investors and dealers should not lose sight of the fact that in a regulated business the fair return which the business is entitled to earn is predicated on the value of the property, and present earnings, unrelated to property value, do not tell the whole story.

Another recommendation of the Investment Bankers' Association committee which has been ignored in many

*Abstract of a paper presented at Great Lakes Division, N.E.L.A., convention at French Lick, Indiana.

offerings is that the circulars should contain a balance sheet of the issuer or a clear statement of capitalization. Of the circulars studied five made no reference whatever to the capital structure. Twenty-six circulars showed the number of shares of common stock, but gave no information as to the amount invested in that stock or as to the value of the equity represented. Two offerings showed the number of shares, with some reference to the amount of the equity, but without definite information. Only eight of the circulars, or less than one-fifth, showed either the investment in the common stock or the value of the equity as measured by the market price of the shares. It is superfluous to say that most of the circulars examined do not give the purchaser the information regarding capitalization which he needs if he is to form any intelligent opinion as to the position of the issue he is to purchase.

A third recommendation of the committee which seems to have been ignored in most cases is that circulars should contain a statement of earnings, including the operating ratio, a statement as to depreciation, the ratio of net earnings to charges and a statement of the issuer's dividend record. This amounts to a restatement of the recommendation of the 1922 committee that sufficient information should be given for a thorough study of earnings, expenses, maintenance and reserves, fixed charges and dividends. Committee reports substantially similar to the 1922 and 1928 reports have been submitted in other years. One might expect to find the recommendations of these committees reflected in offering statements, even though in some cases the distributors are not members of the Investment Bankers' Association, but not only are the recommendations as to information regarding property valuations and capitalization not generally followed but in most of the circulars examined there is no adequate information as to earnings, operating expenses, maintenance expenditures and reserves.

Depreciation and Retirements

Only six of the 41 offerings showed anything definite as to the provision for depreciation or retirements. In four of these the amount was shown for at least one year and in two the provision could be ascertained from other language in the circular. Six circulars made no statement whatever of operating expenses and 29 showed operating expenses, including maintenance and property taxes, but made no showing as to depreciation or retirements. Those circulars which showed the total expenses before depreciation and federal taxes were not in agreement as to what the excess of revenues over such expenses should be called. About one-third of the circulars designated it "available for" depreciation, depletion, federal taxes and return, thus giving some recognition to the existence of these items of expense. In other cases this balance was called "net earnings from operation"; in a third of the cases it was called "net profits," which it clearly was not in most of the instances, and a few circulars referred to it only as a "balance." Those which referred to the balance as the amount available for depreciation, depletion, federal taxes, etc., were probably technically correct, although they failed to give any adequate information regarding the provision for reserve.

Consolidations for Market Purposes

Blue sky regulation is intended to prevent not only the more palpable forms of fraud but unfair and inequitable sales practices as well. The development of standards is slow and the definition of what constitutes unfair practice is evolving gradually. Standards which are unnecessarily harsh and which would interfere with needed development would be unfortunate. We cannot, however, close our eyes to the fact that in many cases recent utility consolidations have not been the result of any logical development in the industry, related to improved efficiency or more adequate service.

Increased marketing facilities, sterner competition in the securities business and the popularity which the high standing of sound and seasoned issues has given to all utility securities have resulted in consolidations of questionable economic or social advantage. Properties scattered throughout the country whose situation could not be improved by a common ownership have been picked up, financed on the basis of valuations which are too frequently unsound and their securities sold on circulars that were not full and frank statements of their position. In some cases the new consolidations have no officers experienced in the utility business and no central organization capable of exercising effective supervision over the properties. Many of such consolidations have all the indications of having been made for the purpose of creating securities to be marketed. They are a menace to the credit of the utility business; they furnish grounds for criticism of a political nature, and they issue securities which are marketed, not so much on their own merits as on the strength of the standing of issues which have popularized utility investments. Not only the existing facilities and business have been mortgaged but the possibilities for years to come have been discounted.

Blue sky law administration should not interfere with legitimate financing even though it be speculative, but it is intended to furnish some assurance to investors that what they buy is what they think they are buying, that speculative securities are sold as such, and that the methods of sale are fair. No exact standard of fairness can be fixed. What might be fair representations to an experienced banker or to a utility operator may be entirely misleading to a great body of purchasers who lack experience and training in the analysis of financial statements.

Whatever improvement can be secured by voluntary action of dealers' associations and by individual houses will help to solve the problems of blue sky administration by eliminating them. Where dealers and their associations fall short, those administering securities sales laws must act in accordance with their best judgment to secure fair dealing. Direct control of personal and printed representations is then inescapable.

Index Published Separately

THE index of the July to December, 1929, issues of the Electrical World will be published as a separate pamphlet with cross references. If you bind your copies and desire an index, just send a request giving your name, company position and address to the Circulation Department, McGraw-Hill Publishing Company, Inc., Tenth Avenue at 36th Street, New York City, and an index will be mailed to you.

Station Apparatus Grounds

CONTINUING the theme introduced in the article on "Protective Gounding Methods," published on page 464 of the ELECTRICAL WORLD for September 7, 1929, there are given here typical recommendations for ground connections to apparatus and structures, adopted from the report of the Engineering Section of the Southeastern Division, N.E.L.A.

Generators and Other Rotating Apparatus.—The minimum size of ground taps for generators, synchronous condenser, converter frames should be as given in the accompanying table for the short-circuit current corresponding to the estimated maximum three-phase symmetrical short-circuit current at the station. Ordinarily the minimum size of ground tap for the neutral of each machine should be equal to the size of the machine leads, unless for some reason these have been made unduly large, in which case the ground lead should be of that size which would have been required for the machine leads, considering conductivity only.

Power Transformers.—The minimum size of ground tap for power transformer tanks should be as given in the table for the short-circuit current corresponding to the estimated maximum three-phase symmetrical short-circuit current on the primary or secondary side, depending on which is the larger. Taps should ordinarily not be larger than No. 2/0 copper except for heaviest equipment, in which case it shall be approximately the size of the power conductors.

Current Transformers.—The minimum size of ground tap for the tanks or frames of outdoor current transformers of all types should be the same as for floor or frame-mounted oil circuit breakers in the same installation except that No. 2/0 B&S gage copper should ordinarily not be exceeded. Taps grounding the secondary lead of the transformer should be No. 6 copper, connected to the tap grounding the tank or frame, except where the diagram of connections requires otherwise, in which case the equivalent grounding of the secondary elsewhere should be shown on the plans or in special instructions. The tanks, frames and cases of indoor current transformers should be connected to the auxiliary ground bus by taps of No. 4 copper, unless instructions are issued otherwise.

Potential Transformers.—The minimum size of ground tap for tanks or cases of outdoor potential transformers mounted on concrete slabs or timbers should be of the same size as the primary lead to the transformer, but not to exceed No. 2/0 copper. Taps grounding the secondary lead of the transformer should be No. 6 copper, connected to the taps grounding the tank or case or the structure on which the transformer is mounted. The diagram of connections for the station shall be the guide for secondary grounding, as cases may arise where the above procedure will be modified. The tanks or cases of indoor potential transformers should be connected to the auxiliary ground bus by taps of No. 4 copper, unless instructions are issued otherwise.

Oil Circuit Breakers.—The minimum size of ground tap for oil circuit breaker tanks or frames, when such breakers are mounted on concrete slabs, should be as given on the table for the short-circuit current corresponding with the estimated maximum three-phase symmetrical short-circuit current at the breaker. In no case shall the conductor be smaller than No. 2/0 copper or larger than the leads to the breaker.

The minimum size of ground tap for oil circuit breaker tanks and frames, when such breakers are mounted in cells, on pipe framework or poles, shall be of the size given in the table for the short-circuit current corresponding to the estimated maximum three-phase symmetrical short-circuit current at the breaker. In no case should the conductor be smaller than No. 1/0 copper or larger than the leads to the breaker.

Minimum Sizes of Ground Connections for Various Three-Phase Symmetrical Short-Circuit Currents

Short-Circuit Amperes	Size Copper Cable
Below 2,000	No. 1/0
2,000– 4,000	No. 2/0
4,000– 6,000	250,000 circ.mil
6,000–10,000	350,000 circ.mil
10,000–15,000	500,000 circ.mil
15,000–20,000	750,000 circ.mil
20,000–30,000	1,000,000 circ.mil
Above 30,000	Multiples of above sizes as required.

The recommended sizes of ground connections given here are based on estimated maximum three-phase short-circuit currents with proper allowance made for such variable factors as (1) resistance to ground, (2) leakage current to ground not passing through conductors, (3) possible variations in connected system capacity, (4) overload protection on transmission lines and other supplies equipment, (5) possible decrement factors, etc. The current-carrying capacity of the ground connection is assumed to be limited by the temperature rise of the soldered joints.

Switches.—The ground tap for line grounding switches should be the same size as the line which it grounds, but in no case smaller than No. 1/0 copper. For bus grounding switches the minimum size of ground taps should be No. 1/0 in minor stations and No. 4/0 in major stations. The mounting of line grounding switches on steel structures should not be considered as grounding.

The minimum size of ground tap for the bases of air-break, disconnecting and selector switches should be No. 2/0 copper, except when such switches are mounted on steel structures no ground tap need be provided. When mounted on poles the bases or supports may be bused together and one No. 2/0 copper tap taken to the ground bus.

Fuse Mountings.—The ground tap for the bases of fuse mountings shall be the same size as the line leads except that it should in no case be smaller than No. 4 copper, and it need be no larger than No. 4/0. When such fuses are mounted on steel structures no ground tap need be provided for the bases.

Lightning Arresters.—Lightning arrester ground taps should be the same size as the line to which connection is made except that for station type arresters the tap should in no case be smaller than No. 1/0 copper in minor stations and No. 4/0 in larger stations, and for line type and telephone arresters the tap shall not be smaller than No. 4 indoors and No. 1/0 outdoors. For station type arresters in major stations $\frac{3}{4}$-in. I.P.S. copper tubing is recommended for the tap instead of cable.

High-voltage lightning arrester ground leads should not parallel closely any metal conductor, such as an arrester supporting frame, and should be protected from mechanical injury. They should be as short and direct as it is possible to make them, both for safety and for effectiveness of the arrester.

Lightning arresters will in most cases have their own ground electrodes separate from other station electrodes. However, a lead should be taken from each arrester electrode to the station ground bus to prevent, so far as possible, differences of potential existing between electrodes.

Arresters 66 Kv. and Above.—A standard driven rod ground electrode of at least six rods should be located close to each arrester installation so that the ground lead will be as short and as nearly vertical as possible.

Arrester 22 Kv. and Up to 66 Kv.—When these are not situated close together each arrester should be provided with a separate driven ground electrode of at least six rods. When situated close together a standard driven ground electrode of at least six rods should be installed centrally and each arrester should be connected to the ground electrode separately by as direct a lead as possible.

Arresters 11 Kv. and Up to 22 Kv.—A central driven ground electrode of at least six rods should be used and the arrester connected to it by as direct a lead as possible.

Arresters Less than 11 Kv.—If there are in the same station high-voltage arresters, each of the low-voltage arresters should be connected to the station ground bus by as short a lead as possible.

Induction Voltage Regulators.—The minimum size of ground tap for both outdoor and indoor induction voltage regulator tanks should be as given in the table for the short-circuit current corresponding to the estimated maximum three-phase symmetrical short-circuit current at the voltage regulator, but not larger than the secondary leads of the regulator.

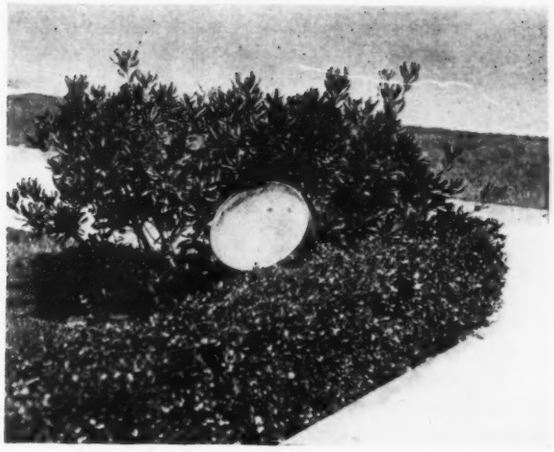
What Makes an Attractive S

Buildings should be in keeping with purpose for which used and with character of surroundings, yet not give an impression of unnecessary expense. Proportions, design, trim, color and landscaping essential elements

As fine and creditable a structure as the most captious citizen might desire of a utility is this substation of the San Diego (Calif.) Consolidated Gas & Electric Company. Costs were not greatly increased.

e Substation?

By R. B. HORNER
Structural Engineer Pittsburgh Branch
Byllesby Engineering & Management Corporation



Shrubbery Conceals Floodlights Adequately if Well Planned

AN INCREASING demand is being felt by industry, as a whole, for improvement in the appearance of the buildings being constructed to house its various activities. This is but one manifestation of the development, by the American people, of a consciousness of the value of art in their daily lives. It is a trend which is in its infancy in the utility industry, but signs of development are rapidly becoming noticeable. This is evidenced by the improvement in the type of buildings now being constructed as contrasted with the strictly utilitarian type of structure erected almost universally only a few years ago.

In considering what should be done to create attractiveness in buildings, it becomes evident that there are many types of architecture which, if properly applied, will give good results. Therefore, it is primarily essential that the men responsible for the architectural design be trained and experienced in this work in order properly to develop the application.

An analysis of the problems encountered, when the design is undertaken, brings out certain fundamental principles which, if borne in mind, contribute noticeably toward obtaining satisfactory results. That a structure should be in keeping with the purpose for which it is to be used might be designated as the first fundamental requirement. In the power industry this means that it

Spanish Architecture Designed for High-Class Commercial Section but Suitable for Residential Area

should have in its composition the characteristics of power. It does not mean an offensive display of strength, but a sturdiness of construction which suggests, rather than declares, its fitness for the purpose which it is provided to serve.

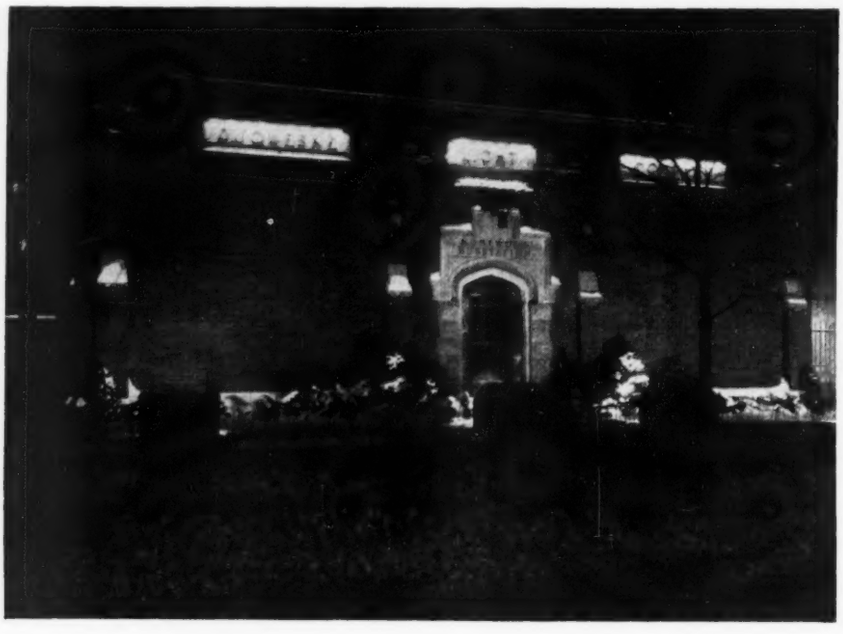
Another requirement is that the building should be in keeping with the character of its surroundings, at the same time exerting an influence in the direction of civic betterment in the community where it is located. For example, while a building utilizing inexpensive materials but embodying good structural lines is in keeping in an industrial district, more refinement of detail and in some cases better materials are found to be necessary in a highly developed commercial or residential center.

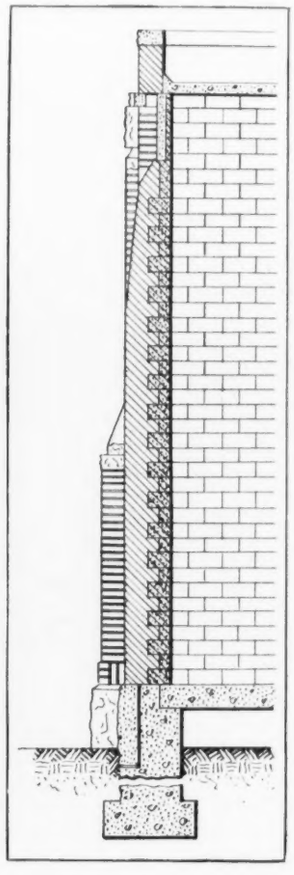
A third essential point is that it must be obvious to the layman that no undue expenditure has been made for architectural effect. The utility industry, being in the nature of a public institution, might easily find itself in an awkward position if the impression were created in the minds of the people that lavish expenditures were being made in this manner. However, this is not a difficult requirement to meet, as there are innumerable examples to prove that good architecture can be obtained by proper planning and selection of materials, the amount of ornamentation being kept to a minimum and not of an elaborate nature. This is dependent on the designer's ability.

A modern adaptation of the Gothic style of architecture has been applied to Homewood substation, of the Duquesne Light Company, located in a residential district. The treatment is simple but vigorous. Little ornamentation is used. The mass of the building itself is emphasized by the absence of windows. The growth of the structure appears natural. The wall surface breaks back on a slope at a point just above the entrance feature (see detail illustration). This throws into relief the central portion of the wall and brings into existence the main pilasters at the corners of the building. The bold manner in which these features break forth as the height of the structure increases develops the strength and ruggedness which are the attributes of power that are needed. The four minor pilasters carry out the theme by reinforcing the lower portion of the building. The use of rough or "rock-faced" stone trim at either side of the entrance and to cap the main pilasters further develops these characteristics, as does also the brickwork, which is laid in a full Flemish bond with raked joints. In this manner the first of the fundamental requirements has been met.

The color scheme is worked out in the selection of the materials themselves. The brick is a soft red, almost a rose tone, while the stone trim is gray limestone.

Homewood Substation Offers Attractive Element in Residential Section with Straight Front Appearance Easily Yet Economically Avoided

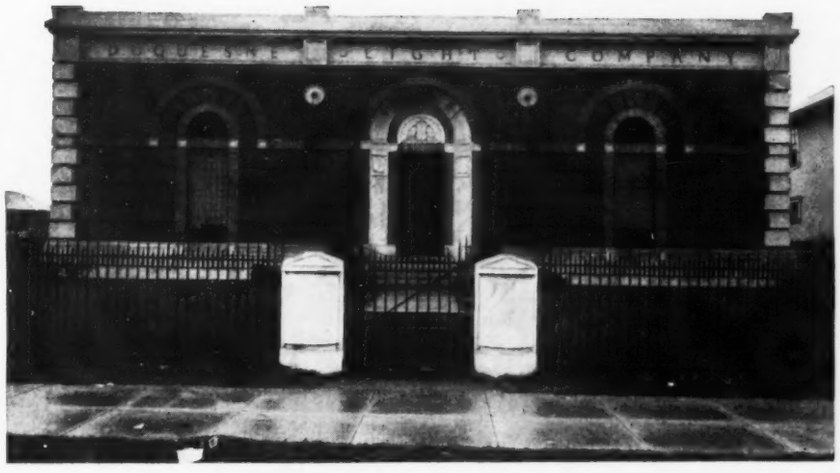




A certain richness is incorporated into the entrance feature by a panel of black and gold marble. The door is of dull surface, dark mahogany finish. The shrubbery at the base of the building, blending into the green lawn, softens and adds life to the whole without detracting from the ruggedness of the construction which has been selected for this station.

A superficial examination shows that no undue cost has been incurred. A moderate amount of stone trim, which is not of an intricate pattern; a small marble panel around the door and the bronze letters to designate the name of the station and its ownership do not constitute a large expenditure. The retaining wall along the front of the property serves a utilitarian purpose, while the heavy pylons rising above the main body of this wall are utilized to house the floodlights which illuminate the front elevation of the building.

The second requirement is met in that this building, located in a residential district, is an improvement over the average building in this community. Evidence, however, that it is not too far advanced for its neighborhood is found in that a new church—a large and imposing structure of French Gothic influence, developed entirely



Coraopolis Substation Designed to Improve Immediate Surroundings

in cut stone—is being built on the opposite side of the street.

A substation showing a marked Spanish influence which is strictly in keeping with the climate and traditions of southern California has been erected for the San Diego Consolidated Gas & Electric Company. It is in a highly developed commercial district, as can be surmised from its dignified simplicity and severity. There is an unmistakable impression of substantialness in this design.

This station meets the first fundamental requirement not by ruggedness and vigor, but by a quiet austerity. The lines and surfaces are for the most part stern. The cut-stone pattern of the stucco walls and the heavy block arch surmounting the bolt-studded door contribute to this feeling. This effect is prevented from becoming too pronounced by the use of the ornamental art stone molding, the iron balconies and the window grills, which are in character with the Spanish treatment. The ornamental mold rising toward the cornice on either side of the door and window ties the structure together and adds to the impression of height in the building. The ornamental nameplate assumes a place of prominence over the window and serves to cap the entrance feature. The repetition of the arches over the entrance and the balcony window in the side elevation of the building continue logically the motif of the front elevation. The coloring effect further tempers the severity. The buff walls range through three light tones, the ornamental molding, plaques and nameplate are sienna (reddish brown) and the roof tile is variegated, with red predominating. The door is of California redwood treated to obtain an antiqued and weathered effect. The generous use of trees, shrubbery and vines is a commendable feature. Here again the materials used in the building and the amount and type of the ornamentation are of such a nature as to avoid any impression of excessive expenditure.

In the third station to be considered, shown on page 1230 and below, an interesting departure from the two previous examples is found. The character of the surroundings rather than the usage of the building has been the predominating influence. The designer, having considered the location, which is along one of the main boulevards, where it is subject to constant observation, and having given special recognition to the residential nature of the community, has subordinated the element of power suggestion and has stressed, rather, the trend toward civic betterment. There is no lack of substantiality, no feeling of flimsiness, in the structure, but the

Located on a Main Boulevard, This Substation Received Special Treatment

impression of sturdiness is subtle and has been obtained by the effectiveness of the completed structure rather than by ruggedness of detail.

The utter simplicity of the main mass of the structure, as typified by the smooth, unbroken surface of the walls, is relieved by refinement of details, as in the ornamentation over the entrance and the well-rounded curves of the molding at the eaves and the arched window openings. The formal lines of the flat stone arch and quoins at the entrance are softened somewhat by the intricate pattern above, but lose little of their strength and gain in interest from this detail. The plaques bearing busts of Franklin and Edison are an interesting tribute to two notable pioneers in the electrical field.

The stucco walls are of a light buff color, the art stone trim being of a shade to harmonize. The roof is a soft red tile, varied in color tone, resulting from a range through dark to light red, with individual tiles bordering on grays and greens. The doors are of dark oak. The ornamental stone is a molded precast material which lends itself readily to decoration at a cost far below that of intricately cut stone.

Landscaping again plays an important part, the shrubbery in this case serving the additional purpose of concealing the floodlights, which are used for night illumination.

The Coraopolis substation of the Duquesne Light Company is located in the heart of a residential district and has been developed by the application of the style of the Italian Renaissance period. This classical order has been used extensively for both residential and commercial design. It lends itself readily to substation work in that any desired strength requirement can be obtained by varying the dimensions of the quoins at the corners of the building and the extent of the rustications, or belt courses, in the body of the wall.

The effect is obtained in this case by the use of a heavy base course of cut stone, above which the treatment is continued in a lighter vein by the rusticated brickwork carried to the spring line of the arched door and window openings. The use of smooth-surfaced brickwork from this line to the nameplate under the coping logically completes the theme of concentrating the greater part of the mass in the base of the structure. The use of these horizontal belt courses, while meeting the requirements for obtaining weight, would result in an impression of lack of height if vertical lines were not introduced partially to offset this effect. These lines are obtained by the use of stone quoins of light color at the building corners, by the stone paneling at the sides of the entrance and by the brick trim at the sides of the windows. The arched openings over the windows and door tend to increase the length of these vertical lines and tie the structure together as a whole.

The coloring in this case is obtained largely in the brickwork, the body of the wall being a soft red, rough texture face brick, the trim around the openings being a flashed brick of the same texture, but burned to a color ranging from a deep purple to a light purple with a red cast. Stone trim is gray limestone The door is hollow metal finished in large grained Circassian walnut of a rather light shade.

A slightly terraced green lawn composes the larger part of the landscaping in this case, just a few evergreens having been grouped around the entrance steps.

Doorways May Be Attractive and Different Without Being Costly Items

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Electric Heat Speeds Making of Washing Machines

By W. A. Smith
Factory Manager Maytag Company, Newton, Iowa

THE manufacture of a device or appliance that is sold in a highly competitive market requires that meticulous attention be given to each separate element in the productive process. The continuous use of electric heat-treating furnaces in the plant of the Maytag Company, maker of the Maytag Washer, at Newton, Iowa, is conclusive evidence of the merit of electric heat application in a manufacturing process whose costs are forced by competition to the lowest possible level.

The Maytag Company now uses four electric fur-

naces, but the data given here apply to only three, the fourth having been recently installed and no great amount of operating experience having yet been accumulated for it. All of the furnaces are of General Electric make. The first is a crucible type cyanide equipment of 16 kw. capacity for rapid surface hardening of small washing machine and gasoline motor parts. The second is an 11-kw. box furnace used for treating production tools. The third is a 37-kw. vertical cylindrical equipment set in the floor so that comparatively large pieces and loads may be handled in and out by suspension means.

The operating methods and schedules of these furnaces are those of usual practice. The production for the three runs is in the neighborhood of 6,600 lb. of metal per nine-hour day at an over-all rate of 6.73 lb. per kilowatt-hour. Controls on all of the furnaces are automatic temperature actuated. The conspicuous advantage of the electric furnace as developed in the Maytag factory lies in the automatic control of temperatures. The assurance that temperatures are correct and will remain correct without human attention throughout the normal cycles of operation is an important factor in the maintenance of production speed.

Letters from Our Readers

Determination of Empty Duct Temperatures

To the Editor of the ELECTRICAL WORLD:

Since the publication of my article on "Carrying Capacity of Cables," in the December 7, 1929, issue of ELECTRICAL WORLD, I have had several requests for information on how to determine empty duct temperatures. Possibly other readers may be interested in this subject.

As was indicated hitherto, the calculation of permissible current carrying capacity resolves itself into a solution of various heat flow problems. In analyzing the series of temperature drops from copper to ambient earth, it is observed that some of these drops are dependent on and proportional to the heat generated in a single duct (e.g., drop in insulation + radiation drop + drop through one duct wall). Others are dependent on the heat generated in part of the subway, as for example, drop between outer layer and next inner layer of ducts and still other drops (through outer layer and from outside surface to earth) are proportional to the total average loss over 24 hours per trench foot of subway.

The more or less exact way of arriving at the air temperature of a duct containing a cable would be as follows:

The total average loss over 24 hours per trench foot $\times$ thermal resistance from outside surface of subway to earth + the total loss $\times$ resistance from outer layer to outside surface of duct bank = temperature drop to duct in outer layer. To this drop is added the resistance between outer layer and next inner layer multiplied by the loss in all ducts inside the outer layer. Such additions are continued till temperature drop from envelope embracing duct in question is reached. Then the drop through one duct wall equal to the thermal resistance of one duct multiplied by the loss in a single duct is added to get the air temperature.

Obviously such computations are very laborious, especially since the root mean square value of load current over 24 hours should be used for determination of losses.

Numerous approximations have been proposed for the simplification of the computation of these drops. The most commonly used consists of adapting a duct constant H, which, when multiplied by the loss in the subway, gives the drop from duct air to earth. If n is equal to the number of equally loaded cables in the bank, Drop $= n$ loss$_1 \times H$ or $(n H)$ may be added to the radiation resistance and insulation resistance for use with the watts loss in one cable. The errors and approximations in this method may be seen by comparison with the exact method described above. Chief among these are the facts that the earth resistance $\times$ total loss + subway resistance $\times$ fractional loss + single duct resistance $\times$ single cable loss are embodied in a single multiplication of $n H \times$ Loss per single cable. No provision for earth resistance variation or duct position is made. The value of 1 is very generally used for H. Some authorities recommend 1 for a four-duct subway and 0.75 for twelve-duct and up. Still others are as high as 1.4 and as low as 0.57.

The Bureau of Light and Power of Los Angeles has studied the temperature drop in various subway banks and has divided them into several stages. The drop proportional to the loss in one cable through a single duct is taken as 0.6 $\times$ loss in one cable. The drop from the outside surface of a bank and proportional to the total loss in the subway bank (4 by 4) is taken as 0.7 $\times$ the loss of the bank. Drops between various layers throughout the bank are obtained and constants are given, which, when multiplied by the loss in the cable of one of these layers, will give the actual drop between certain points.

It appears that general agreement is reached as regards the drop through a single duct and the drop from the surface of a subway bank, the former being proportional to the loss in one duct and the latter being proportional to the average loss in the subway. Difficulties arise when these drops are incorporated with the drops through the various portions of the duct. Obviously the second method described here is much more accurate than the first. Another method which appears to be highly satisfactory is that developed by W. B. Kirke, Brooklyn Edison Company. He recognizes the various drops considered by the Los Angeles Bureau, but rather than obtaining these by multiplying by the losses in a single cable, he uses the total subway loss multiplied by suitable constants for the various ducts. Though the drop to an inner duct should be obtained by multiplying the total loss by a constant for the soil and the outer layer of duct, and to this should be added the drop due to a fractional part of the total loss multiplied by another constant, the total loss is used for both of these factors and the compensation necessary is made in the heating constant. The values of heating constant which he recommends based on approximately 50 per cent load factor are approximately equal to 6 divided by (number duct high + number duct wide) in the case of outer duct. These values are increased approximately 25 per cent for the next inner layer of duct. Multiplying the average 24-hour loss per trench foot by H gives the drop to an empty duct. The additional drop through insulation, from lead and through one duct wall, due to the loss in a single duct, must be added to obtain copper temperatures.

THOMAS F. PETERSON,
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American Steel & Wire Company.
New York City.

Digest of Foreign Literature

Hydro-Electric Development and Steam Equipment

Scientific Developments in Steam-Driven Power Station Practice.—DAVID BROWNLIE.—Modern trends in steam-generating practices have been outlined by the author in connection with a general review of the subject of steam generation. Particular attention has been given to the control of sulphur and ash in the fuel gases. The possibility of better control through low temperature carbonization and similar innovations has been considered. A number of these scientific elements have been reviewed briefly.—*Electrician (England)*, November 1, 1929.

Modern Surface Condensing Plant and Feed Systems.—JOHN EVANS.—In recognition of the rapid development of the surface condenser during the past few years and the consequent attention given to the low-pressure side of steam turbines, the author has endeavored to point out the design tendency both in Europe and America and particularly to indicate the trends which may lead to further improvement. A number of interesting developments have been mentioned in this discussion, and some perplexing and apparently impossible results in the matter of temperatures have been analyzed in an endeavor to explain unusual operating phenomena in British stations. — *World Power (England)*, November, 1929.

Generation, Control, Switching and Protection

Refrigeration of Electrical Apparatus.—A consideration of the possibility of using pressure gas instead of oil for transformers and switchgear. Following the various attempts that have been made to eliminate the use of oil in circuit-breaking equipment, both in this country and abroad, the French Professional Association of Producers and Distributors of Power has recently considered the use of refrigerating machinery and high-pressure gas to increase the security of operation of power station and substation apparatus. The proposal is put forward that the oil in transformers and switches be replaced by gaseous atmosphere at a pressure of several kilogrammes per square inch. That atmosphere would have about the same dielectric and thermal properties as the oil, without its inconveniences, as the gaseous medium, air, nitrogen and carbonic acid gas have been considered. The transformer tanks could be built for a pressure of 113 lb. per square inch and arranged with external cooling coils, probably being not much more expensive than the tanks for oil with vertical oil circulation tubes now available. The compressed gas in these tubes could be cooled with the aid of refrigerating plants. It is the opinion of the author that without material modification of the general installation of transformers or alternators oil or air circulation system could be energetically cooled with the aid of a refrigerating plant, the security and overload capacity of the plant being greatly increased; in transformers oil could be replaced by gas under pressure, cooled either by the usual cooling coils in atmospheric air or by means of a refrigerating plant, and the replacement of oil switches by switches under gas pressure. —*Electrical Review (England)*, November 22, 1929.

Report on Oil Switches.—Official Report of the "Conférence Internationale des Grands Reseaux."—At the fourth session of the committee on large power systems, held at Paris, 1927, an extensive questionnaire was sent out to a great many manufacturers and operating companies to collect data, experiences and criticisms on high-voltage, oil-immersed circuit breakers. This inquiry was handled by the Swiss section of the committee. The present report is a condensed collection of all data received. It gives, first, the theoretical basis of the evaluation and the testing of breakers, comparing rules of five foremost countries (America, Germany, England, Switzerland and France). Conclusions are drawn from the replies received and recommendations are made for a possible international code on oil switches, which would allow a uniform rating and testing of breakers. Considerable information is contained in the various operating experiences with breakers of all kinds in a great number of installations.—*Bulletin de l'Association Suisse des Electriciens*, November 1, 1929.

Transmission, Substations and Distribution

20-Kv. Underground Transmission System of Crown Mines, Ltd. — W. ELSDON-DEW and H. DENEHY. — An innovation in electrical practices has been instituted in a South African mine. The distribution of energy from the switch house to various transformer stations, the farthest being over 6,000 ft. from the point of origin and nearly 5,000 ft. vertically displaced is unprecedented. The potential being 20,000 volts and the vertical placement varying so greatly from common practice, it was necessary to devise a special type of cable and to draw up specifications to insure satisfactory results. The cable has been tried out through use over a period of several months and is said to have been entirely reliable and satisfactory. Further installations are planned. The authors have indicated the conditions which have been met, the specifications drawn up, the method of manufacture, and operating characteristics. — *Electrical Review (England)*, October 11, 1929.

Overhead Lines or Underground Cable.—R. F. CROMPTON and ALFRED EKSTROEM.—According to the authors, the most important part of the grid scheme which is being used in the reorganization of the electrical supply of England is the development of the 33-kv. feeders radiating from selected power stations to distribute in bulk to undertakings supplying the surrounding urban and rural districts. An analysis of comparable installations for overhead and underground service has been made, indicating that under the same working conditions there is very little difference in cost. Special cable-laying machines, devised for rapid excavating and repairing of the earth, have been employed. — *Electrician (England)*, November 8, 1929.

Units, Measurements and Instruments

Amplifiers for Measuring Purposes.—M. ARDENNE.—The measurement of small amounts of electric currents is difficult, due to the exceedingly small torque or other action, which may be derived from it to accomplish the measurement. As soon as the amplifying action of vacuum tubes became known, efforts were therefore made to utilize this property for measuring purposes. How this can be done for direct current and what new lower limits can thus be reached have been previously shown by other investigators. But little has been done so far to amplify small quantities of alternating current, particularly high frequency alternating current. A useful application of a vacuum tube method utilizes a Brown tube for oscillographic records of exceedingly faint alternating-current waves, such as occur in radio transmission.—*Elektrotechnische Zeitschrift*, November 7, 1929.

The Apparatus Directly Visualizing the Complete Light Distribution Curve.—MASAIE HORIOKA. — The ordinary method of obtaining a light distribution curve is to plot point by point in the directions properly divided around the light source and to trace these points into a continuous polar curve. This requires a considerable amount of time and is a relatively tedious job and necessitates a photometric expert for getting accurate results. Furthermore, the expedient fails almost entirely in the case of special shades and globes, especially those whose flux distributions have a markedly sharp variation. In order to overcome these defects, the author developed an apparatus for recording the complete light distribu-

tion curve on a light sensitive plate by means of a photo-electric cell and subsequently modified this apparatus so that any complete and continuous light distribution curves can be directly indicated so that both an intermittent and exact knowledge of the flux distribution of any luminaire may be obtained. A complete description of this apparatus, which is said to have proved extremely satisfactory in practice, is given.—*No. 268, Researches of the Electrotechnical Laboratory (Japan)*, 1929.

Heat Applications and Material Handling

Electricity for the Home.—In order to determine the relationship between the size, shape and material of utensils used for cooking, and the energy required to achieve the desired results, analyses were recently undertaken, and the results are reported upon in this discussion. Six variations were subjected to the test, ranging from the correct size of utensil and the proper position of heating element, through small and larger sizes, and the convex and concave bottoms, to oblique positions of the elements in relation to the utensil. Energy consumption varied widely, as did the time in minutes required to achieve comparable results. The test involved bringing four pints of water from 55 to 212 deg. F. and energy consumption varied from 0.282 to 0.705 watts, with time requirements of 9½ minutes to 23½ minues. — *Electrical Review (England)*, November 22, 1929.

An Electric Heating Installation. — The heating of the offices of a corporation involved in the distribution of electricity is now being carried out electrically, the old coke-fired boilers having been replaced by a 216-kw. capacity electric boiler. The existing system of central heating by means of radiators and pipe work has been retained, since it was considered that the capital expense of installing direct electric heating in the various rooms and scrapping the radiator system would be unnecessary. The heating load is approximately 180 kw. and in order to allow for the most severe conditions the actual loading is 216 kw. The elements which may be withdrawn from the boiler while the latter is full of water and even partially under load are of the unit type and are loaded at 3 kw. apiece. They are connected in circuits between line and neutral at 230 volts, three in a circuit and three circuits balanced on the three phases to form one control step. The complete loading consists of eight steps of 27 kw. each and each control step has its own thermostat, which is inserted in the end of the boiler above the elements and actuates a solenoid contactor mounted on a control panel. Automatic control is used and in order to guard against sudden loads eight thermostats are set approximately 6 deg. apart from 185 deg. F. downward. The lag on each thermostat is approximately 2 deg. to 3 deg. and in heating up from cold all the thermostats start by being in and are cut out one by one as the temperature rises to a maximum of 185 deg. Hand operation is used for operation in periods ordinarily not requiring boiler operation. — *Electrical Review (England)*, November 15, 1929.

Electrophysics, Electrochemistry and Batteries

Test of the Properties of Insulating Materials.—O. R. RANDALL.—A discussion of some of the methods which may be used to investigate insulating materials and a description of an attempt made to place the testing of such materials upon a more exact footing than has previously been known. The properties involved are: Body resistance, contact resistance, and capacity effects. The author has indicated a number of variations in test arrangements which permit unusually satisfactory results. A number of factors entering into the situation have been analyzed with a view to minimizing errors and simplifying procedures. Some of the elements entering into this consideration have been given as temperature changes, humidity changes, proportionality between current and voltage, time intervals between readings, the direction of current across a contact, and sensitivity of contacts.—*Engineering (England)*, November 15, 1929.

Traction

The Great Indian Peninsula Railway. —This is the first instance of main line electrification in India and follows four years of successful suburban electrified work in the vicinity of Bombay. Approximately 170 miles of track are involved and many benefits are anticipated. Power required for the railway is generated in a 40,000-kw. plant with extra supply at various points from other electrical connections. A description of the generating facilities, transmission lines, substations and overhead equipment is included in this discussion. Overhead supply has been used with suspension at 220-ft. intervals by double porcelain disk insulators of the ball and socket pattern, and the contact wire is suspended by loop type contact wire clips. — *Electrical Review (England)*, November 22, 1929.

Telegraphy, Telephony, Radio and Signals

Oscillation Power Output of a Triode System and Principle of Its Optimum Design.—EIJIRO TAKAGISHI.—In pursuing his researches and mathematical investigations on this subject, the author has prepared continuations of his earlier paper referring to maximum and optimum conditions and principles of design. Following a consideration of the oscillations for a distortionless amplifier, subsequent chapters have been devoted to other types of oscillation, such as self-oscillator, power amplifier, etc. It was the author's mathematical prediction that operating conditions could be predetermined and a sufficient degree of coincidence found for designing purposes between the theoretical results and the values obtained from the experiments carried out by the wattmeter method. In addition to the maximum conditions, the conditions of utilizable maximum net power output or the minimum power input applying to the various items in the section have been fully investigated. Several contour charts for some important factors have been prepared with a view to facilitating means of designing the optimum triode system. No. 264-266 *Researches of the Electrotechnical Laboratory (Japan)*, 1929.

Miscellaneous

Electricity in Agriculture, with Special Reference to Electro-Culture. — WILLIAM PHOENIX.—The author has considered not only the general subject of the relation of electricity to agriculture but also the new development of electro-culture. It is stated that a special knowledge of rural areas must be obtained by engineers if any progress of considerable note is to be made in the electrification of the farms in Great Britain. Distribution by underground cables is cited as being preferable to overhead lines and the reasons are given therefor. Future lines of load development in rural areas are suggested, while the application of electricity on farms and the rates therefor are analyzed. In connection with the discussion of electro-culture, air-earth current, earth current, seed treatment and other methods have been analyzed. The air-earth current or the discharge method is dealt with in detail and rules for its application are given. Some experiments with an alternating-current discharge are described. It is suggested that the simplicity of this system and the success of the experiments justify further investigation along similar lines.—*Journal of the Institution of Electrical Engineers (England)*, November, 1929.

Iron-Silicon-Carbon Alloys. — T. D. YENSEN.—The author has undertaken to discuss the constitutional diagrams and magnetic properties of various alloys utilized for their magnetic properties in electrical machinery. The effects of various heat treatments upon the character of materials have been pointed out and the reasons for improvement under treatment indicated. An endeavor has been made to co-ordinate the constitutional diagrams with the metallographic evidence available, and it is asserted that there are many gaps in the available evidence. It is stated that by means of the diagrams it is possible to explain the various magnetic phenomena exhibited by iron and iron-silicon alloys, both after slow and rapid cooling. According to the author, magnetic testing is evidently much more sensitive in detecting small quantities of certain impurities, like carbon, and the form in which they exist, than in either metallographic or ordinary chemical analysis. — *Electrician (England)*, November 8, 1929.

News of the Industry

Hughes Proposes Cut in Chicago Diversion

As Special Master He Recommends to Supreme Court that Sanitary District's Levy on Lake Michigan Be Reduced to 6,500 Sec.-Ft. by July 1

THE long dispute over the diversion of water from Lake Michigan by the Chicago Sanitary District, with its effect on Great Lake levels and incidentally on proposed and possible development of power on rivers fed by the lakes, reached a new stage on December 17, when Charles E. Hughes, acting as special master at the behest of the United States Supreme Court, rendered his report to that tribunal. (See ELECTRICAL WORLD for January 19, page 167.)

In his report Mr. Hughes recommends that the diversion be reduced from the present 8,500 sec.-ft. to 6,500 sec.-ft. on July 1, 1930, with the completion of the Sanitary District's North Side disposal plant. He proposes the construction of controlling works to prevent reversal of the current of the Chicago River and canal, by means of which the diversion would be reduced to 5,000 sec.-ft. in two more years. Mr. Hughes' schedule calls for the Calumet plant of the Sanitary District to be completed by December 31, 1933, a West Side plant by December 31, 1935, and another plant by December 31, 1938.

After the last-mentioned date the Sanitary District should not, Mr. Hughes says, unless Congress imposes a different requirement, divert more than an annual average of 1,500 sec.-ft. a second in the interests of navigation in the Chicago River. This would be in addition to water taken by Chicago for municipal purposes. Such an ultimate maximum diversion would have the effect of lowering the level of Lakes Michigan and Huron one inch, the special master asserts.

Chicago will file exceptions to Mr. Hughes' report.

Federal Radio Commission's Term Extended

Indefinite extension of the administrative life of the Federal Radio Commission, so that it may sit as the licensing agency until permanent communications legislation is enacted, was authorized December 16 by Congress with the passage of the Dill-White bill. Under existing law the commission would have become a radio appeals body on December 31, with regulatory authority transferred to the Department of Commerce. The Senate adopted the measure without a record vote. It carries a provision for the appointment by the commission of a chief engineer, at $10,000 a year.

Hearings before the interstate commerce committee anent the Couzens Federal Communications Commission bill have been adjourned to January 7.

W. S. Lee for President of Institute

Vice-President and Chief Engineer of Duke Power Company Officially Nominated — Selections for Vice-Presidents and Directors Also Made

NEXT in line for the presidency of the American Institute of Electrical Engineers is William S. Lee, vice-president and chief engineer of the

William S. Lee

Duke Power Company, Charlotte, N. C. His nomination by the national nominating committee of the Institute, consisting of fifteen members from various parts of the country, was announced on December 16. Ratification by the membership next spring, of course almost a certainty, will bring the office to Mr. Lee for the Institute year beginning August 1, 1930. Other nominations by the committee for the same term follow:

For Vice-Presidents:

Northeastern District: I. E. Moultrop, chief engineer Edison Electric Illuminating Company of Boston.

New York City District: H. P. Charlesworth, vice-president Bell Telephone Laboratories, New York.

Great Lakes District: T. N. Lacy, chief engineer Michigan Bell Telephone Company, Detroit.

Southwest District: George C. Shaad, dean School of Engineering and Architecture, University of Kansas, Lawrence.

Northwest District: H. V. Carpenter, dean of mechanic arts and engineering and director of engineering experiment station, State College of Washington, Pullman.

For Directors:

A. B. Cooper, general manager Ferranti Electric Limited, Toronto.

A. E. Knowlton, associate professor of electrical engineering, Yale University, New Haven.

R. H. Tapscott, electrical engineer, New York Edison Company.

For National Treasurer:

George A. Hamilton, electrical engineer (retired), Elizabeth, N. J.

A biographical note on Mr. Lee is printed under "News of the Industry" (page 1246).

Edison Medal Is Awarded to Charles F. Scott

The Edison medal of the American Institute of Electrical Engineers has been awarded to Charles F. Scott, professor of electrical engineering at Sheffield Scientific School, Yale University, New Haven, Conn., "for his contributions to the science and art of polyphase transmission of electrical energy." This announcement, issued by the Institute, was first made public on Thursday morning. The ELECTRICAL WORLD will next week contain a biographical sketch of the recipient.

Hydro Bows to Steam in Western States

Montana Power to Complete 50,000-Kw. Morony Plant in 1930 and Tacoma 54,000-Kw. Cushman No. 2, but Fuel Plants Will Lead

CONFIRMATION of the strong trend toward steam rather than additional hydro generation on the Pacific Coast, as reflected from time to time in the columns of the ELECTRICAL WORLD, is found in the figures now available for construction in 1929 and coming construction in 1930. In 1929 only 38,000 kw. of hydro capacity was added in the eleven Western States as against 113,000 kw. of steam. Next year will see 189,000 kw. of hydro capacity added, but steam generation will be increased by 270,000 kw.

Low fuel costs and increased efficiency of steam generation, coupled with stationary hydro costs and efficiency, plus the fact that the most economical hydro sites of reasonable size have already been developed, have definitely placed hydro out of the picture in southern California. A similar situation obtains in central and northern California. In

the Pacific Northwest, too, utilities are turning strongly to steam generation. In the entire eleven Western States only two hydro-electric plants of major importance will be completed during 1930. These are the 54,000-kw. Cushman No. 2 plant of the city of Tacoma and the 50,000-kw. Morony plant of the Montana Power Company. Contrasted with this there will be added in steam by the Southern California Edison Company and the Pacific Gas & Electric Company 100,000 kw. each, 35,000 kw. by the Portland Electric Power and a like amount by the Puget Sound Power & Light, totaling 270,000 kw.

Nor is the economic balance in favor of steam likely to change soon. Prodigious quantities of cheap natural gas in California and low-priced oil and coal elsewhere in the West promise to maintain the present trend for a long period. Hydro-electric plants will continue to produce a majority of the energy, but the future will, it is prophesied, see replacement of old inefficient prime movers with modern equipment and a strong tendency toward automatic and semi-automatic operation to reduce production costs in existing plants rather than so much new construction.

"Lexington" Goes to Aid of Tacoma

United States Ship's Generating Machinery Will Be Used to Augment Municipal Plant Energy—Method Used in Making the Interconnection

A DISPATCH from Secretary of the Navy Adams to Mayor J. G. Newbegin of Tacoma, Wash., sent on December 12, announced that the Navy Department would comply with the Northwestern city's request for aid to its publicly owned hydro-electric light and power plant, hard hit by the long-continued drought, and would supply energy to Tacoma from the airplane carrier *Lexington* (then anchored in Seattle Harbor) during the emergency for a period not in excess of 30 days.

Physical connection between one of the ship's four 35,200-kw. General Electric turbo-generators and the Tacoma municipal system was completed on Wednesday, December 18. Despite any difficulty that may arise from a difference in frequency, the *Lexington's* generators being operated at 50 cycles and the municipal plant at the standard 60 cycles, delivery of 20,000 kw. for a period of 30 days is promised. This emergency arrangement will permit complete shutdown of the Cushman hydro-electric plant to permit the filling of its storage reservoir to a point that will assure an adequate power supply for the anticipated period of low water during the freezing weather of January and February. The Nisqually River plant, now operating at its full capacity of 24,000 kw. from stream flow, is expected, plus power from the 9,000-kw. Tacoma steam plant and the *Lexington*, to be able to carry the daily load, ranging between 40,000 kw. and 45,000 kw. Peaks will be carried with the assistance of the Seattle municipal system and the Puget Sound Power & Light Company.

In making the connection the *Lexington* was anchored 30 ft. from the dock in 80 ft. of water. From a temporary bus erected in the ship's motor room twelve cables are carried to a door in the hull 20 ft. above the water line and thence across barges to a temporary substation set up on flat cars on the dock. The high side of the transformers is connected to two miles of specially constructed 50,000-volt transmission line tying in with the Tacoma system.

The rate at which the *Lexington's* power was offered to Tacoma is understood to be a fixed charge of one-quarter cent per kilowatt-hour for 20,000 kw. at 50 per cent load factor plus 1 cent per kilowatt-hour for all energy actually delivered. Temporary construction work, dock charges and other incidentals are expected to make the energy taken cost approximately 1.5 cents per kilowatt-hour.

The 25 per cent curtailment in power supply imposed in Tacoma upon the city's largest industries has been rescinded.

Rain and Snow Relieve Power Situation on Coast

Rain and snow in the last two weeks have done much to break the drought in the Northwest, including British Columbia. Snow is also reported in the California Sierra, and a general rainfall in northern California has broken the drought there.

With a rainfall of 3.89 in. during a three-day period and the mountainous regions covered with an average 20 in. of snow, water-power shortage in Oregon has been definitely relieved. According to forecasts made by the United States Weather Bureau in that state, snowfall in the mountains will continue indefinitely and more or less continued rains may be expected until early spring.

Colorado Reports Absence of Water Shortage

Reports from Colorado say that water in all the streams of that state has been more than ample for all power and irrigation purposes during the 1929 season, allowing plenty of surplus for usual storage purposes. Snowfall far above normal has been precipitated on the eastern watershed, which augurs favorable conditions during next year. Practically all Colorado hydro plants are equipped with steam standby equipment which has not been used this year because of abundance of water.

A report from Utah made on December 6 stated that the snowfall in that section is considerably below normal but that there did not exist on the date named any water shortage. There is still time for ample snowfall.

Utility Investigation Will Resume January 8

Sharp Criticism of Electric Bond & Share Company Implied in Federal Trade Commission's Latest Interim Report to the Senate

HEARINGS in the Federal Trade Commission's investigation of electric and gas utilities will be resumed Wednesday, January 8, when utility associations will present material giving their side of the publicity phase of the inquiry. The presentation for the utilities will be made by B. F. Weadock. The commission completed its examinations into publicity activities of utility associations in October. The financial phases of the inquiry will be taken up in hearings to begin soon after January 8. No definite date has been determined. This part of the investigation will be presented in relation to affiliated groups of companies.

In its eighteenth interim report to the United States Senate, dated December 16, the commission deplores the stand taken by the Electric Bond & Share Company in opposing the production of certain records and refusing to answer certain questions. On this point the report says:

The Electric Bond & Share Company, one of the largest factors in the industry, derives substantially all its income from companies in which it has a substantial interest, either directly or indirectly, and whose operations, construction, financing etc., it manages. This income is in the form of dividends on common and preferred stocks, interest on bonds, notes and advances, fees for supervisory and other services in connection with the operations of associated companies and their plant construction and commissions on their financing. Officers of the Electric Bond & Share Company refused to produce before the commission in response to its subpœnas the books and vouchers containing the record of its operating expenses, and hence of the cost of the service for which it makes service charges to operating companies, and to answer certain questions put to them at public hearings. . . .

Even though it should prove impossible to determine all the facts desired, owing to insufficient records, the specific conditions that militate against such a determination should be ascertained and the need of remedying such a situation considered. Where companies collect such fees from their affiliated operating companies, as to which the companies receiving the fees are in a position of influence or control, a valid subject for investigation and recommendation is presented under the resolution, which specifically refers to the earnings and expenses of these holding companies and their affiliated service or management corporations. The commission therefore deems it essential to a complete investigation that the books and documents demanded be produced and proposes to avail itself of every legal means to that end.

Purchases and Mergers

By 1,020 to 554, Shelbyville (Ill.) voters on December 10 authorized the sale of the municipal electric plant and distribution system to the Central Illinois Public Service Company for $250,000 and granted to the utility a 25-year franchise. The transfer marks a quarter century of municipal electric plant ownership and an almost equally long campaign on the part of the Central Illinois to establish its service in the city.

Purchase of the hydro-electric plant of the Dells Paper & Pulp Company at Eau Claire, Wis., by the Northern States Power Company was consummated last week, and the power company will take possession not later than May next.

The New York Public Service Commission has consented to the transfer by the Vestal Lighting Company of its franchises and other property to the New York Electric Corporation. The Vestal company now obtains its electricity from the Binghamton Light, Heat & Power Company, which has also petitioned the commission for consent to transfer its franchises and property to the New York Electric Corporation.

Applications have been filed with the New York Public Service Commission by the Inlet Utilities Corporation and the Old Forge Electric Corporation covering the proposed transfer of the franchise and system of the first named to the second named and the merger of the Inlet company into the Old Forge company.

Transfer of the transmission system of the Tazewell (Va.) Electric Light & Power Company to the Appalachian Electric Power Company has been effected as forecast in a previous issue, thus ending a confused situation in Tazewell and North Tazewell which led to litigation.

West Point, Miss., is considering the Mississippi Power Company's offer to buy the utilities of the city. The company's offer amounts to $1,200,000, or $60,000 a year for twenty years.

Water Is Easy, Power Hard to Divide on Upper Colorado

Although no official recommendations were made at the recent conference of Colorado, Wyoming, New Mexico and Utah delegates in Denver, tentative figures revealed suggest that a government referee, to be appointed chairman for a January meeting in Denver, will be asked to allocate Colorado River waters, under the Boulder Dam pact, to upper basin states about as follows in acre-feet: Colorado, 4,500,000; Wyoming, 1,500,000; Utah, 1,000,000; New Mexico, 500,000. This will dispose of the 7,500,00 acre-feet designated to the four states' use.

It is forecast that the states will have no great difficulty agreeing on water division, since Colorado, which furnishes approximately 12,000,000 acre-feet, demonstrates a willingness to accept a much smaller amount of the river's waters than it might presumably claim. A battle, however, is in prospect over utilization of power to be derived from hydro equities.

Unanimous choice of the delegates fell on Colonel William J. Donovan to be the federal conferee, and a telegram recommending his appointment was dispatched to Secretary of the Interior Wilbur. Colonel Donovan has an intimate knowledge of Western river conditions. Another meeting is to be held as soon as word from Washington assures the presence of a government representative.

Publication of the letter of protest sent recently by representatives of the four states to Secretary Wilbur shows that it urged the sale of power to the highest bidder and that the tentative price of 1.63 mills a kilowatt-hour suggested by the Secretary was too low and would favor California.

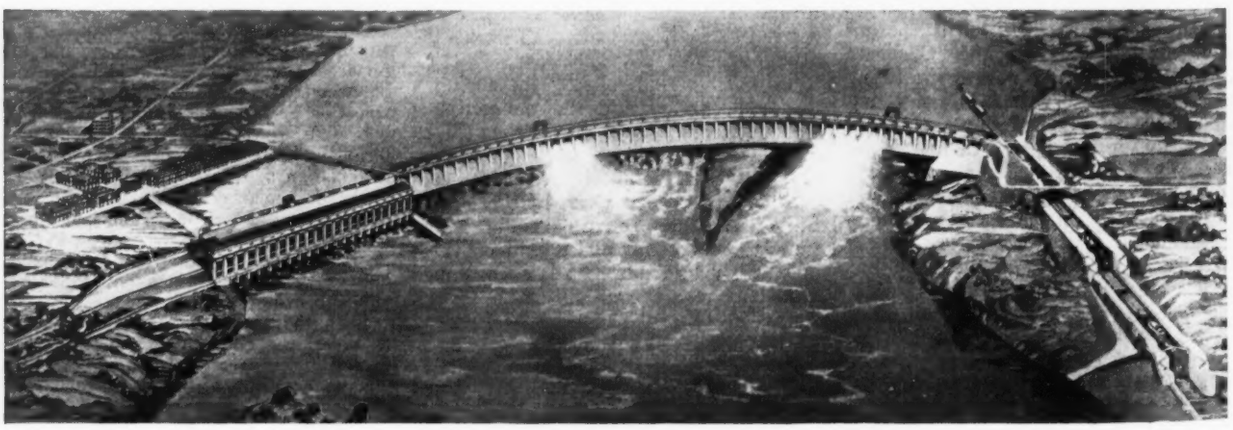
Arizona Will Not Confer with Upper Basin States

Governor Phillips of Arizona announces that Arizona, though it asks to be allowed to send an observer, will not be officially represented at the conference of the Upper Colorado River Basin states to be held in January under federal government auspices to discuss allocation of water. The failure of Arizona to become a party to a tri-state agreement with California and Nevada was given as the reason for declining the invitation to participate.

Boston Edison Company Will Serve Concord, Mass.

By a vote of 528 to 418 at a special town meeting last Monday, the citizens of Concord, Mass., decided to purchase energy at wholesale from the Edison Electric Illuminating Company of Boston instead of enlarging the existing municipal steam plant on the historic Concord River. Last spring the town refused to accept the company's offer to purchase the municipal lighting plant at a price of $600,000, but a ten-year contract favored by the voters on Monday provides that if the town decides to sell the plant within the next three years, the price will still hold.

Perspective of Dnieper River Hydro-Electric and Navigation Project



NOW in process of construction at Kichkas, Republic of Ukraine, by the Soviet government, and about 35 per cent completed, the Dnieper River project when ready in 1934 will be the center of a superpower system for the support of existing and future industries within a radius of 300 miles. The area served will be about 70,000 square miles. This area, supplied with low-cost electric power and attractive rail and water transportation, should eventually be the home of an industrial population of approximately eight million people. The saving in coal due to the use of hydro-electric power from the Kichkas power station will be about 3,000,000 tons annually. Hugh L. Cooper & Company, New York, are the American consulting engineers, and Mr. Cooper has made several trips to Russia.

Here are some figures concerning it: Estimated concrete content all structures, 1,500,000 cu.yd.; over-all length of masonry structures, 5,000 ft.; height of dam above rock foundations, 200 ft.; average operating head, 116.5 ft.; length of spillway section, 2,005 ft.; length of power house, 820 ft.; initial installation, number of turbines, 4, producing 330,000 hp.; ultimate installation, number of turbines, 9, producing 750,000 hp.; annual production for the ultimate installation, 2,500,000,000 kw.-hr.; estimated cost of project, including navigation facilities, $110,000,000.

Radicals' Day in Commission-Law Inquiry

Harry W. Laidler and Norman Thomas Think Little of Regulation as Now Practiced — Indiana Commissioners Give Opinions

ANOTHER advocate of a public defender as part of the machinery of utility regulation appeared before the legislative investigating commission inquiring into the Public Service Commission laws of New York State when F. T. Singleton, a member of the Indiana regulatory body, gave testimony late last week. Mr. Singleton followed on the stand Howell Ellis, also of the Indiana commission, who condemned interference with regulation by federal courts and all federal encroachment on the regulatory functions of the state.

"I have the highest respect for our federal courts," Mr. Ellis said, "but it appears incredible to me that state regulatory commissions are always wrong in their judgment of the evidence in valuation cases."

Mr. Ellis saw no need for the regulation of holding companies, maintaining that they could be held in check through sufficient regulation of operating companies. He testified that the Indiana commission makes utilities pay the full cost of gathering all information necessary in a rate case and described the maintenance by the commission of a special department to deal with informal complaints. Mr. Singleton, however, declared, in contradistinction to his colleague, that he favored regulating holding companies. He also favored a law forbidding appeal to United States courts until a case had been carried through the state courts.

On Monday, December 16, Walter J. Fitzpatrick, chief accountant of the Public Service Commission, recommended that control over mergers and acquisitions should be extended to a point where the Public Service Commission would have something positive to say on the basis of financing and exchange of securities among the merging companies.

Dr. Harry W. Laidler, executive director of the League for Industrial Democracy, made radical recommendations, declaring that regulation had broken down. He proposed an integrated federal, state and municipal system of power development under public auspices. With the State Power Authority, which he suggested as a foundation for immediate action, Dr. Laidler coupled plans for encouraging municipal plants and the formation of power districts to generate electricity in behalf of combinations of municipalities.

On Tuesday Norman Thomas, the Socialist leader, was heard. He had much fault to find with the commission and its members. His principal proposals included the determination of a fixed rate base for every utility without the inclusion of "such illusory terms as 'going value,'" the limitation of a fair return on value to about 6 per cent, and the fixing of future increase in property value at the actual additional investment. He would have holding companies declared to be public utilities and subject to the commission, and he proposed that municipalities and consumers' organizations be entitled to participate in all utility cases. To aid this purpose he suggested a people's counsel who would be independent of the commission.

Wednesday the investigating commission met at Buffalo and Thursday at Syracuse. Meetings in New York City will probably be resumed on January 2.

Trunk Line for New York

Short Niagara-Hudson Interconnections Will Supply 110-Kv. System from Jamestown via Niagara and Albany to Massachusetts Border and On

COMPLETION of two short sections of 110-kv. transmission line, work on which is now in progress, will provide a main trunk line of that voltage running across New York State from Buffalo through Albany to the Massachusetts state line and in effect serving as the backbone of the great network of transmission lines over which electrical energy is dispatched to the communities served by the Niagara-Hudson Power Corporation system. One of the final links in the line, between Rotterdam and Johnstown, is being built by the New York Power & Light Corporation, and the other, between Buffalo and Lockport, is being constructed by subsidiaries of the Buffalo, Niagara & Eastern Power Corporation. The other sections of the line have been built during the past five years. At the Massachusetts state line a connection already exists with the system of the New England Power Association, whose system is tied in with the system of the Edison Electric Illuminating Company of Boston.

The immediate completion of this trunk line, which is one of the first major operations of the Niagara-Hudson Power Corporation system, will make possible the exchange of power throughout the state on a larger scale than ever before. The new power artery will be about 500 miles long. Its route through New York State is from the Pennsylvania line near Jamestown to Niagara Falls and Buffalo, Lockport, East Rochester, North Syracuse, Oneida, Utica, Amsterdam, Rotterdam, North Albany, and to the Massachusetts state line at Stephentown. Here it connects with the 110-kv. trunk line of the New England Power Association running to Boston by way of Adams, Davis Bridge and Worcester. The three systems making up the Niagara-Hudson Power Corporation have a total generating capacity of 1,149,980 hp. in hydro plant and 502,700 hp. in steam stations. The New England Association has a connected capacity of more than 533,300 hp., and the Boston Edison company, also interconnected through the trunk, has steam stations with a capacity of 400,000 hp.

Federal Accountants Dispute Company Valuation

Another case in which accountants of the Federal Power Commission and appraisers for a hydro-electric company appear to be at wide variance in the matter of pre-license valuation has received newspaper publicity. (See ELECTRICAL WORLD for December 7, page 1142.) In this case an inflation of $60,000,000 was alleged to have been found in the capital assets of the Niagara Falls Power Company. To explain their contention the accountants said:

The examination disclosed that considerable property which had been abandoned and demolished was still carried in whole or in part in the plant investment account, that many large amounts in connection with new construction appeared to have been erroneously charged to property investment, and that many millions of dollars carried in the plant investment account did not represent actual investment either by the company or by its predecessors.

Paul A. Schoellkopf, president of the company, gave out a statement at Buffalo which read:

An erroneous and misleading statement has appeared in certain newspapers regarding the capital valuations of the Niagara Falls Power Company and the relations of the company to the Federal Power Commission in this matter. The capital accounts of the Niagara Falls Power Company are not inflated. The question involved relates to agreements as between the Federal Power Commission and the company on the fair values of the company's property at the time license was granted in 1921. The company in November, 1928, indicated to the Secretary of War, chairman of the Federal Power Commission, its desire to proceed with the case with a view to reaching a final decision at any time the Federal Power Commission might designate. So far the Federal Power Commission has not set a date for a hearing.

Westinghouse Building Central Engineering Laboratory

Work has already been started by the Westinghouse Electric & Manufacturing Company on an eleven-story structure at East Pittsburgh which will serve that manufacturer as a central engineering laboratory. It will be on Braddock Avenue, between Cable Avenue and Arbor Street. Adjacent to this building will be a 125-ft. extension to the direct-current laboratory of the company. On the two projects $1,500,000 will be spent, President F. A. Merrick said:

The buildings will house one of the world's best equipped electrical laboratories. Generators big enough to supply electricity to a town of 10,000 people will be used merely for experiments. Artificial lightning for testing insulating materials will be produced by a high-voltage surge generator. Test circuits of almost any voltage and frequency will be provided for. Making artificial weather—hot or cold—will be every-day routine in the weathering rooms, where sunshine or rain, winter cold or summer heat, will be produced for testing apparatus built for outdoor service. In another room any given set of atmospheric conditions of temperature, pressure and humidity may be accurately reproduced.

Beerbower Station Ready

New Oklahoma Power House Goes Into Operation—Byllesby Companies Have Four More Steam Plants Under Way

VIRTUAL completion of the Oklahoma Gas & Electric Company's 15,000-kw. Lincoln Beerbower station near White Eagle, Okla., is announced by H. W. Fuller, vice-president in charge of engineering, the two initial units having gone into service many days ahead of scheduled time. Completion of this station brings the total capacity of the Oklahoma Gas & Electric Company's system up to 160,706 kw. This will be further augmented next year by a 30,000-kw. steam-electric station, construction of which has recently been started near Belle Isle Lake in Oklahoma City.

Three other steam plants are being constructed by the Byllesby Engineering & Management Corporation. The James H. Reed station of 60,000 kw. capacity being built on Brunot Island in Pittsburgh for the Duquesne Light Company is to be ready for operation on August 1, 1930. The work of installing the turbines will begin January 1. For the Northern States Power Company's 20,000-kw. station at Granite Falls, Minn., and the 10,000-kw. addition to the Coos Bay station of the Mountain States Power Company the major equipment has been ordered and schedules are being got ready.

Governor Moody to Ask Again for Texas Commission

Governor Dan Moody of Texas has renewed his recommendations for the enactment by the Legislature of a law placing public utilities under state control. When the Legislature meets in special session in January, he will again submit the plan. Describing the development of the electric power and other public utility interests in Texas, Governor Moody said the other day:

Within the last few years large and powerful public utility companies have grown up in this state. The large ones have swallowed up the smaller ones and become larger until practically every town and village is being served by one.

In nearly every town the public utilities are without competition in the service which they severally offer and have a monopoly of their particular business. The necessity for regulation and control is evident. Somebody should stand between the consuming masses and the company or companies furnishing public utility service to the public. The power and duty to regulate the conduct of such companies and the rate to be charged, under a holding of the Supreme Court of the United States, rest on the state legislature. Some of the larger cities have the power of regulation, but with this exception and the limited control which the Railroad Commission has over gas companies, there is practically no regulation of this big industry. If exorbitant rates are being charged the consumer, the average city or town is practically without the legal power and finances, under existing law, necessary to correct the abuses or to make an inquiry into the matter and bring about an adjustment. Our statutes were written when there were few utilities in this state, and for the most part such as existed were small local concerns.

Every public utility company is entitled to a fair return on the reasonable value of the property used in the public service, after the legitimate cost of operation is deducted, but it is impossible for any city, without tremendous expense, to make the necessary inquiry to determine what rate would yield such return. . . . The time has come in Texas when steps should be taken for the supervision and regulation of these utilities.

Muscle Shoals Bills Are in Statu Quo

President's Views May Prevail, but the Norris Resolution Is Ready for Possible Repassage and Other Legislation Will Be Considered

MUSCLE SHOALS legislation at the present session of Congress is being agitated from several quarters, and it remains to be seen whether any bill embodying the views expressed by the President in his annual message will command such support as to alter materially the *status quo* now prevailing.

On the Senate calendar is the Norris resolution to create a new federal agency, the Muscle Shoals Corporation of the United States, and authorize Congress to appropriate a fund of $10,000,000 for its functioning. The bill is backed by a favorable report from the military committee. The three directors of the corporation would be appointed by the President and subject to confirmation by the Senate. Under them a general manager, appointed for ten years, with two assistant managers, would have general control and management of the corporation. In a general way, this corporation would be empowered to purchase or lease and hold personal property. To it the federal government would turn over its real property at Muscle Shoals. Under this plan the government would complete the steam plant at Muscle Shoals, install additional machinery at Dam No. 2 and build Cove Creek Dam, that dam to be turned over to the corporation for control and management.

The Norris resolution is in much the same form as the measure which was vetoed by President Coolidge. It does provide for the payment to Alabama and Tennessee of 2½ per cent of the gross receipts from the sale of power. This is in lieu of the taxes which would accrue to those states were the project placed in private hands and is held by some to constitute an acknowledgment that government operation has been projected into the field of private business. It is expected that the House committee will frame a government operation bill of its own, but it probably will follow the lines of the Norris resolution. There is still talk of reviving the Cyanamid bill, but indications are that no such bill as that last offered could pass.

Two bills have been in the hands of the House committee on military affairs. One of these, sponsored by Representative Wright of Newnan, Ga., would authorize and direct the Secretary of War to execute a lease with the Air Nitrates Corporation and the American Cyanamid Company. The other, introduced by Representative Hogg of Fort Wayne, Ind., provides for preservation, completion, maintenance, operation and use of the United States Muscle Shoals project for war, navigation, fertilizer manufacture, electric power production, flood and farm relief.

There is a good deal of talk in Washington as to the waste of power at Muscle Shoals, but it is difficult to see how there could be any other outcome when the Alabama Public Service Commission will not allow an increase in transmission line capacity. The capacity of the existing line is 80,000 hp. The Tennessee Electric Power Company, partly with the idea of interconnecting with steam plants in Alabama and partly with the idea of utilizing secondary power at Muscle Shoals, is building the 60-mile link necessary to connect its system with Muscle Shoals.

Amendments to the Norris resolution which would direct the completion of Dam No. 3 and the leasing of the nitrate plants for the manufacture of commercial fertilizer at a rental of $1 a year have been introduced in the Senate by Senator Black of Alabama.

Bids for leasing the government plant at Muscle Shoals will be received by the committee up to January 15, 1930, and hearings on Muscle Shoals will begin some time in January, the committee announced orally this week.

Columbia Presents Historic Apparatus to Ford

Historical electrical apparatus collected through the efforts of the late Francis Bacon Crocker after he had taken charge of the newly founded department of electrical engineering at Columbia University in 1889 has been presented to Henry Ford by that university, according to announcement by Professor Walter I. Slichter of Columbia.

The collection will go to Edisonia, the museum Mr. Ford is founding in honor of Thomas A. Edison at Dearborn, Mich. It consists of more than 190 pieces which constituted the entire museum formerly housed in the electrical engineering laboratories at Columbia. Because of lack of space, however, the apparatus and machinery were not easily available.

Among the most valuable articles sent to Dearborn are one of the several Wallace arc-light generators now in existence, the two Edison bipolar generators which supplied Columbia University with electricity in early days, and the original loading coil invented by Professor Michael I. Pupin at Columbia and destined more than any other single factor to perfect the quality of speech transmitted over telephone lines. The last-named item was personally presented by Professor Pupin.

Briefer News

PARIS (TEX.) COUNCIL VOTES DOWN MUNICIPAL PLANT REFERENDUM PLAN.—The proposal to construct a municipal electric light and power plant at Paris, Tex., at a cost of $450,000, has been blocked by the refusal of the City Council to submit the proposal to vote of the people. The Council voted three to two not to call for a referendum.

NEW RATES FOR SOUTHERN SIERRAS POWER STAND. — The California Railroad Commission has denied the petition for rehearing filed by the Southern Sierras Power Company, Riverside, on the recent order of the commission reducing the rates of that company approximately $300,000 a year, and the new rates have been ordered into effect on all meter readings taken on and after January 16.

ROANOKE RIVER PLANT TO BE FINISHED IN TWO YEARS. — The long-projected hydro-electric plant for the Virginia Electric & Power Company, to be built on the Roanoke River at Roanoke Rapids, N. C., near the Virginia border, will, according to a statement from the company's office at Richmond, be begun next year, and the first unit will probably be installed in the latter part of 1931. Ultimately the plant will produce 55,500 hp.

PACIFIC COAST COMMERCIAL MEN TO GET TOGETHER AGAIN.—The second conclave of the Commercial Section of the Pacific Coast Electrical Association will be held in the Fairmont Hotel, San Francisco, on January 9 to 10. C. E. Greenwood, commercial director N.E.L.A.; Charles T. Hutchinson, president McGraw-Hill Company of California, and Leon O. Whitsell, member California Railroad Commission, will be among the speakers.

PORTLAND ELECTRIC POWER COMPANY HAS BOTH STEAM AND HYDRO GENERATING UNITS PLANNED FOR 1930.—Installation of a new 35,000-kw. steam turbo-generator at Station L in Portland and of an additional generator and waterwheel of 25,500 kw. rating at the Oak Grove hydro plant are included in the program of the Portland (Ore.) Electric Power Company for 1930. The foundations for the hydro unit were completed in 1929. Together the two additions to capacity will cost $2,601,750. Transmission systems will be increased and strengthened.

CONDEMNATION SUITS UNDER WAY FOR BAGNELL DAM PROPERTY.—Condemnation proceedings to acquire property which will be inundated by water backed up from the great dam to be built near Bagnell, Mo., have been instituted in federal District Court at Jefferson City by the Union Electric & Power Company of St. Louis, builder of the water-power project. Seventy-five thousand acres are needed for the reservoir. Of the amount the operating company has acquired 30,000 acres.

NEW RATES FOR GEORGIA POWER & LIGHT COMPANY.—The Georgia Public Service Commission has established a new and lower rate for electric light and power in Valdosta, Waycross, Bainbridge and twelve other cities served by the Georgia Power & Light Company. The new rates include a service charge of $1 per month, with a charge of 6 cents per kilowatt-hour for the first 50 kw.-hr., 3 cents for the next 150 and 2 cents for all in excess of 200.

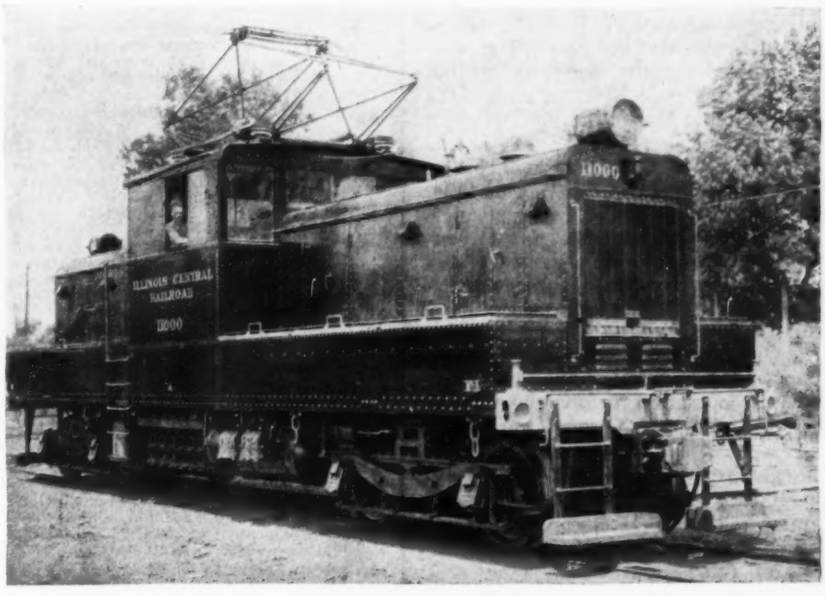
PUBLIC SERVICE ELECTRIC & GAS EXPLAINS LATEST RATE REDUCTION.—Details of the rate reduction recently announced, effective January 1, by the Public Service Electric & Gas Company of New Jersey show that it will mean reductions for residential customers using more than 50 kw.-hr. a month, the rate for consumption in excess of this amount being cut from 5 cents to 3 cents. On the general lighting rate there is a cut of 1 cent after consumption of 1,000 kw.-hr.

GOVERNOR ROOSEVELT SAYS PUBLIC "PAYS THROUGH NOSE" FOR ELECTRICITY.—There was no let-up in Governor Roosevelt's criticism of utilities to be seen in a talk recently made by him before college students of New York City. In this speech he declared that the people in his state "pay through the nose for electricity and gas." He repudiated any socialistic designs, however, and observed that proper state development through a well-selected commission would prevent any misuse of the power resources or inefficiency in their utilization.

MICHIGAN ENGINEERING SOCIETY TO CELEBRATE FIFTIETH ANNIVERSARY.—The fiftieth anniversary of the founding of the Michigan Engineering Society will be observed at the fourth engineering conference at the University of Michigan, Ann Arbor, on January 30 and 31 next. Among the speakers at the conference will be Robert P. Lamont, Secretary of Commerce; Frank C. Emerson, Governor of Wyoming, and Dr. Alexander G. Ruthven, president of the University of Michigan. The general theme will be "The Engineer's Contribution to the Art of Living."

MISSISSIPPI POWER COMPANY TO CUT RATES.—Before a joint committee of the Mississippi Legislature which is inquiring into the financial structure of public utilities, including questions of rates, assessment and taxation, capitalization and physical values of the properties and the intercompany connections, the Mississippi Power Company of Jackson recently announced a cut in rates that will amount to about 8 per cent to the consumers and will cost the utility between $200,000 and $250,000. The rates will be offered to more than one hundred of the municipalities served by the company. The new schedules,

Three-Power Locomotive Improves Operation



A COMBINATION oil-engine, storage-battery and external-power locomotive is now being tried out by the Illinois Central Railroad as a possible solution of the smoke and noise abatement problem in urban switching service. (See ELECTRICAL WORLD for November 16, page 998.) So satisfactory has been the performance of this engine that 42 similar ones have been ordered by the New York Central Lines. It works 24 hours per day and is out of service only eight hours each week for inspection and upkeep. It is flexible, quiet and fast.

which are to be submitted to the various municipalities for acceptance, provide for a flat service charge of $1 for each customer and a flat rate of 5 cents per kilowatt-hour in addition to the service charge. The present rate is 10 cents a kilowatt-hour in the bulk of the communities, with no service charge.

NEW SUBSTATION TO AID DAYTON-SPRINGFIELD (OHIO) INTERCONNECTION.—A new substation for the Dayton Power & Light Company at Trebein, Ohio, will be completed January 1 and used in supplying power to the Ohio Edison Company, Springfield, over the new transmission line connecting Dayton and Springfield. The station is of all-steel and brick construction, including a separate brick building for control equipment, but will be of the remote-control type, being operated from the power substation at Xenia. It will be known as the Beaver substation.

TEXAS INTERCONNECTIONS GO STEADILY ON.—An interconnection of the transmission lines of the West Texas Utilities Company and the Central Power & Light Company will be made soon near Rocksprings. Extensions of power lines of wooden-pole construction to the interconnecting point are being made by both companies. An additional step-down station will be erected at Sonora to support the 132-kv. extension to Rocksprings and Uvalde. The interchange of power will supply West Texas Utilities properties south of San Angelo with three-way service and will be an important link in that territory.

BOSTON EDISON'S MYSTIC STATION NOT TO BE RUSHED.—President Charles L. Edgar of the Edison Electric Illuminating Company of Boston made it clear this week that the generating plant contemplated by the company on the shore of the Mystic River in Everett, to be named the Mystic station, will not be undertaken immediately. It is expected that the first unit will be in operation not later than the fall of 1934. Immediate expansion of the company's steam-plant facilities has been considered unnecessary on account of arrangements for increased power interchange between the Edison company and the New England Power Association, whose initial hydro-electric development at Fifteen-Mile Falls is expected to be in operation before the end of next year.

POTOMAC ELECTRIC POWER PLANS ITS ANNUAL RATE REDUCTION.—A substantial reduction in electric rates, effective January 1, is forecast on the basis of calculations which show that the Potomac Electric Power Company of Washington will earn approximately $1,242,336 this year in excess of a 7½ per cent return on its valuation. Under a compromise agreement between the company and the commission in 1924, in settlement of the company's appeal from the valuation of its property by the commission, the company each year is required to reduce rates if the net earnings in the preceding year exceed 7½ per cent of the valuation. The earnings in excess of this percentage are divided equally, the company taking one-half and the consumers the other in the form of reduced rates. Last year the bills were cut by $625,000.

VERMONT CONSUMERS OPPOSED TO "READINESS-TO-SERVE" ROOM CHARGE.—An application by the Green Mountain Power Corporation of Vermont for leave to establish a "readiness to serve" charge of 20 cents a room met with much opposition recently at hearings before the state commission. Opposing petitions were received from Barre, Burlington, Waterbury, Essex Junction, Williston and Vergennes. The company, it was brought out, has always operated on a direct charge for energy consumed and proposed to reduce this charge and add the "readiness to serve" item. Attorney-General J. Ward Carver said there was a widespread protest against the new rate. He recommended a rate change without the room feature.

DIXONVILLE-NORTH BEND (ORE.) LINE GOES INTO SERVICE.—The new 110-kv. single-circuit transmission line extending from Dixonville to North Bend, Ore., a distance of approximately 65 miles, known as line 20 of the California-Oregon Power Company and connecting the system of that company with the system of the Mountain States Power Company in the Coos Bay district, has been placed in service. This line is connected to line 12 of the California-Oregon Power Company at Dixonville. Line 12, approximately 123 miles in length, extending from the Prospect hydro-electric plant north to Springfield, Ore., had formerly been operated at 66 kv. In connection with the construction of the new line, line 12 was reinsulated for 110 kv. These undertakings necessitated new or enlarged substations at Prospect and Dixonville on the California-Oregon system and at Springfield and North Bend on the Mountain States system. An addition is now being made to the Coos Bay steam plant, which is to be ready for service July 1, 1930.

ULTIMATE OUTPUT OF 270,000 HP. LOOKED FOR FROM LIEVRE RIVER, QUEBEC.—Excellent progress is being made in the construction of the power dam on the Lievre River at High Falls, Quebec. When the dam is completed next year a total of 120,000 hp. will be developed, the sale of a great proportion of which has already been arranged for. Later on a second development of between 30,000 hp. and 40,000 hp. will be undertaken, and a third site, which engineers of the company have located on the river, is capable of producing another 120,000 hp., making a possible and ultimately likely development on the Lievre River by this company of 270,000 hp.

CONTINUED EXPANSION OF PUBLIC SERVICE COMPANY OF OKLAHOMA.—The Public Service Company of Oklahoma has completed plans to double the capacity of its Weleetka generating station on the Canadian River. Announcement that work on a new 15,000-kw. turbo-generating unit and two 1,000-hp. boilers equipped with tubular-type air heaters is now in progress has been made by Fred W. Insull, president of the company. Ground for the addition will be broken at Weleetka on February 1. The new unit will bring the station to 30,000 kw. Building of the addition will mean constructing a second 66,000-volt transmission line between the company's West Tulsa and Weleetka plants.

P. G. & E. SUMMARIZES ITS MAIN 1930 CONSTRUCTION.—The Pacific Gas & Electric Company reports that its engineers and builders are rushing the reconstruction of station "A," its steam plant in San Francisco. The building, as previously told, will be enlarged and remodeled and four steam turbines will be installed to raise the capacity from about 64,000 kw. to 225,000 kw. Although two turbines will be put in at once, the rebuilding of the station will require five years to complete. The total cost will be $11,000,000. As a preliminary move, the oil-burning equipment was removed a few months ago and the boilers are now fired with natural gas. The same change was made

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue of July 6, page 46.]

American Engineering Council—Washington, Jan. 9-11. L. W. Wallace, 26 Jackson Place, Washington, D. C.

Conference of Electrical Leagues—Westinghouse Lighting Institute, New York, Jan. 13-16. Society for Electrical Development, 420 Lexington Ave., New York.

Empire State Gas and Electric Association—Women's Section, Hotel Seneca, Rochester, Jan. 16-17. C. H. B. Chapin, Grand Central Terminal, New York.

National Electrical Manufacturers' Association—New York, Jan. 20-24. S. N. Clarkson, 420 Lexington Ave., New York.

North Central Division, N.E.L.A.—Commercial Section, St. Paul Hotel, St. Paul, Jan. 20-21; Engineering Section, Nicollet Hotel, Minneapolis, Feb. 24-25. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

National Electrical Credit Association—New England Division, University Club, Boston, Jan. 21. F. P. Vose, 1008 Marquette Bldg., Chicago.

American Institute of Electrical Engineers—Winter meeting, New York, Jan. 27-31. F. L. Hutchinson, 33 West 39th St., New York.

National Electrical Wholesalers' Association—Pacific Division, Del Monte, Calif., Jan. 31-Feb. 1.

Artistic Lighting Equipment Association—Washington, Feb. 9-15. C. L. Benjamin, 420 Lexington Avenue, New York.

at station "C" in Oakland. Under the heading of major jobs "started in 1929, to be completed in 1930," come the new Lyons Dam, 20 miles east of Sonora, which will cost $430,000; the enlarging of the Bear River canal to increase the output of Halsey power house, near Auburn, which will take another $875,000; the construction of the Morgan Hill-Salinas 110,000-volt transmission line at a cost of $275,000; the San Mateo-San Carlos tower line, at an expense of $219,000; additional equipment at substations "D," "I" and "J," San Francisco, to cost $217,000, and new transformers at station "B," San Jose, to cost $103,000.

Paying for City Plants from Future Earnings

Nebraska Supreme Court Sustains This Method as in Conformity with Existing Statutes, Though Legislature Refused to Sanction It Last Spring

NEBRASKA newspapers are commenting on the fact that although the State Legislature last spring defeated a measure favored by the League of Municipalities which would have specifically permitted cities to contract with manufacturers to install generating plants to be paid for in part from future earnings, the Supreme Court of the state has just handed down a decision permitting them to do so and thus indicating that cities have all along possessed such power.

The case was that of Carr vs. Fenstermacher and concerned the city of Sargent. (See ELECTRICAL WORLD for September 28, page 659.) In its decision the court holds that municipalities have the power to pledge future net earnings of their publicly owned lighting plants for payment for new equipment and extensions; that while the statute says they "may" finance these by taxes or bond issues, the word does not have the effect of "shall" and the language does not bar the employment of other methods. The court says that the power of a city to install and maintain a municipal lighting plant by means of a tax levy or a bond issue may, for such purposes, imply power to make a cash payment from funds already on hand and to pay the remainder of the purchase price out of net earnings of the plant, the two methods named not being exclusive. It adds that the grant of power to a city to engage in such enterprises carries with it the implication that it may exercise it in addition to statutory powers to achieve its purpose. The duty of a city to fix reasonable rates for electrical energy furnished to consumers through a municipal plant is held not to be violated by a contract to purchase necessary equipment and to pay a portion of the price out of future net earnings, where the contracting parties agree that such earnings shall be based alone on lawful charges. The court also holds that the charter provision requiring an appropriation in advance of incurring indebtedness does not apply.

Recent Court Decisions

SUPREME COURT SUSTAINS ORDER AGAINST MAINTENANCE OF FLASHBOARDS ON MOHAWK RIVER.—The Little Falls Fibre Company and other companies with plants on the Mohawk River which complained against the use of flashboards installed on the United States dam at Troy, N. Y., by Henry Ford & Son, have been upheld by the United States Supreme Court at Washington, which has affirmed the finding of the state courts. (See ELECTRICAL WORLD for October 20, 1928, page 808, and January 26, 1929, page 217.)

NO LIABILITY FOR DEATH OF BOY WHOSE COPPER KITE STRING TOUCHED PROPERLY INSTALLED TRANSMISSION LINE.—Dilley vs. Iowa Public Service Company was a suit for damages because of the death of a boy whose copper kite string came into contact with an uninsulated 33,000-volt transmission line 40 ft. above the street. Its franchise gave the company by inference the right to maintain the line, and it was shown to be constructed in a proper manner and in accordance with the Electrical Safety Code. Moreover, there was a city ordinance against flying kites in the streets. The Supreme Court of Iowa, therefore, affirmed judgment for the defendant. (227 N.W. 173.)*

COMPANY OWED NO DUTY TO BOY CLIMBING BRIDGE GIRDERS EXCEPT NOT WILLFULLY TO INJURE HIM.—Death met a fourteen-year-old boy who climbed bridge girders and came in contact with electric wires, receiving a shock which caused him to fall. The Appellate Court of Indiana affirmed judgment for the defendant in a suit for damages (Kent vs. Interstate Public Service Company). It was held by the appellant that the wire should have been insulated at the point of danger. The court held that this plea might have held in the case of a workman lawfully on the girders, but that the boy was a trespasser to whom the company owed no duty save not to injure him willfully. (168 N.E. 465.)

WARNING TO CONTRACTOR DID NOT EXEMPT POWER COMPANY FROM LIABILITY FOR INJURY TO LABORER BECAUSE OF MAINTAINED MENACE.—Walz vs. Public Service Electric & Gas Company was an action by an employee of a company dismantling a chimney who was injured while taking an iron bar up to the roof over the side of the building. Evidence that defendant power company maintained uninsulated an electric wire carrying 13,000 volts and so exposed that persons engaged in work might come in contact therewith, and that the iron bar came in contact with this wire, showed, the Supreme Court of New Jersey held, that the defendant maintained a deadly menace and public nuisance, and was sufficient to sustain recovery. The fact that the electric company gave warning to the contractor for whom the laborer worked did not exempt it from such liability. (147 At. 654.)

NO LIABILITY FOR UNUSUAL ACCIDENT NOT READILY TO BE ANTICIPATED AS POSSIBLE.—Observing that the law does not require one who maintains even so dangerous an instrumentality as highly charged electric wires to anticipate at his peril every possible circumstance under which some person might make a contact with such a wire and incur injury or death, the Second California District Court of Appeal found in Sweatman vs. Los Angeles Gas & Electric Corporation, an action for damages because of the death of a workman who while on the fifth floor of a building under construction moved a metal rod out of a window and brought it in contact with an uninsulated high-voltage wire, losing his life as a result, that the company was not liable. Supporting the theory that it is the duty of one maintaining electric wires to insulate or otherwise protect them from contact at places where persons may reasonably go, such a duty, the court held, does not extend to insurance against all risk whether reasonably to be expected or not. (281 Pac. 677.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

NEW ORDER REGARDING DAMS IN CALIFORNIA.—The California Railroad Commission has revoked its previous general order requiring public utilities to file, subject to the approval of the commission, plans and specifications for the construction, reconstruction, alteration or repair of all public utility dams before beginning such work, and has issued a new general order, effective January 7, requiring such plans and specifications to be filed with the commission within thirty days after their approval by the state engineer, California Department of Public Works. This action was taken after public hearing as the result of the enactment by the last State Legislature of the dam-control act giving to the state engineer jurisdiction over all dams within the state.

ALLOCATION OF VALUE OF ELECTRIC SYSTEMS IN TWO STATES.—In an investigation into the rates and business of the Eastern Shore Gas & Electric Company of Maryland, the Maryland Public Service Commission, referring to the valuation arrived at by its own engineer, said: "The commission understands Mr. Wolf's allocation of values to be an effort to determine the extent to which property in Maryland is used for serving Delaware communities and vice versa. His allocation of power-plant values is based upon the amount of current consumed in each state and the allocation of transmission-system values is based upon the lengths of the transmission circuits which are used jointly and the amounts of current transmitted over each circuit, for use in each state, as determined by transformer capacity. The commission believes that an allocation of values for such purpose cannot reasonably be misunderstood to be a transfer of property from one ownership to another and considers it to be as accurate and equitable as any method that could be employed under existing conditions. The amount which Mr. Wolf calls 'properly allocated to Delaware' is understood to be the amount by which the value of that portion of the property in Maryland which is being used in generating and transmitting current which is sold to the Delaware company for consumption in the State of Delaware exceeds the value of Delaware property used in the service of Maryland consumers. This is value upon which the Maryland companies are entitled to earn a fair return, but such return should be included in the price charged."

News About Men of the Industry

R. F. Whitney Promoted in N. E. Power System

Roy F. Whitney, for a number of years president and general manager of the Fall River (Mass.) Electric Light Company, has been placed in a ranking executive position in the southern properties of the New England Power Association, with headquarters at Providence, R. I. He is now president of the Attleboro, Fall River, Mystic, South County and Seekonk companies of the association and vice-president of the Narragansett Electric and Tiverton Electric Light companies.

Middle West Utilities Elects New Officers

Samuel Insull, Jr., has been elected vice-chairman of the Middle West Utilities Company, Oliver E. McCormick vice-president in charge of treasury department, E. A. Davis vice-president in charge of auditing, W. S. Vivian vice-president in charge of public relations and Dempster MacMurphy vice-president in charge of publicity. L. B. Breedlove was elected an additional assistant to the president.

EDWIN E. DRESSE, chief engineer of the Lincoln Electric Company, Cleveland, Ohio, has been appointed professor of electrical engineering at Ohio State University, effective January 1.

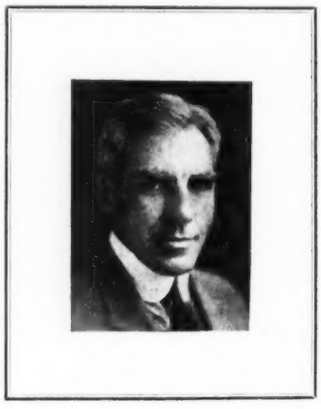
J. B. ARTHUR has been appointed mechanical engineer of the Humble Oil & Refining Company, Houston, Tex. Mr. Arthur was formerly in the employ of Stone & Webster, Inc., and since September, 1928, has been assistant to the chief electrical engineer of Charles H. Tenney & Company, Boston, Mass.

DUNCAN S. OWLER has been appointed superintendent of distribution of the Seekonk Electric Company and Attleboro Steam & Electric Company, in addition to retaining the duties of his present position as superintendent of the Fall River (Mass.) Electric Light Company. The above properties have recently been added to the New England Power Association system. HAROLD H. BODGE, power sales engineer of the Fall River Company, has been appointed sales manager of the Fall River, Tiverton, Seekonk and Attleboro companies.

AUGUST H. JAEGER has been appointed first vice-president of the Leonard Refrigerator Company, Grand Rapids, Mich., according to an announcement made by the board of directors of the Leonard company. Mr. Jaeger joined that organization in March, 1926, as assistant sales manager and before the close of the year he was elected secretary and sales manager. As first vice-president he will continue to handle the duties of general sales manager. Before affiliating himself with the Leonard organization Mr. Jaeger was, for ten years, with the Hotpoint Electric Heating Company and prior to that time he operated a branch electrical supply jobbing house in Seattle, Wash.

E. O. Shreve Assistant Vice-President G. E. Company

E. O. Shreve, manager of the industrial department of the General Electric Company, Schenectady, has been appointed assistant vice-president on the staff of Vice-President J. G. Barry. Previous to heading the industrial department Mr. Shreve spent some time on the Pacific Coast, starting as supply salesman in San Francisco in 1906. In



1909 he was made apparatus salesman in the lighting department and in the summer of 1917 he was named assistant manager of the San Francisco office. One year later he was promoted to be manager of the office, which position he held until he removed to the East as manager of the industrial department.

Mr. Shreve was born in Mapleton, Iowa, and was graduated from the Iowa State College in 1904 with a B.S. degree in engineering. He became a student engineer in the test department of the General Electric Company and within a year was transferred to what was then the supply department.

CHESTER N. CHUBB, president of the Iowa-Nebraska Light & Power Company, Lincoln, Neb., has gone abroad to spend a year in research work in the interests of the United Light & Power Company.

F. L. HIGGINSON has been elected a director of International Paper & Power Company. Mr. Higginson is a partner in Lee, Higginson & Company and is widely known in financial circles throughout the country.

W. S. Lee Receives A.I.E.E. Nomination

William States Lee, who has received the official nomination for president of the American Institute of Electrical Engineers for the term beginning August 1 next, as announced in this issue under "News of the Industry," has been a pioneer in high-voltage hydro-electric power development and transmission. A native of Lancaster, S. C., Mr. Lee was awarded the degree of civil engineer by the Citadel, the military college of South Carolina.

Following his early engineering experience he was appointed resident engineer at the Anderson (S. C.) Light & Power Company in 1897, resident engineer of the Columbus (Ga.) Power Company in 1898 and chief engineer of the latter in March, 1902. One year later he was appointed chief engineer and in October of that year vice-president and chief engineer of the Catawba Power Company, Charlotte, N. C. This company was a subsidiary of the Southern Power Company and in 1905 he became chief engineer of the latter company. He later received the appointment of vice-president and chief engineer, which position he held for about fifteen years. He is at present vice-president and chief engineer of the Duke Power Company. Among Mr. Lee's other connections are the following: president of the W. S. Lee Engineering Corporation, president and chief engineer of the Piedmont & Northern Railway Company, vice-president and chief engineer and director Duke Power Company, Wateree Power Company, Western Carolina Power Company, Catawba Manufacturing & Electric Power Company, director American Cyanamid Company, vice-chairman and trustee of the Duke Endownment. He is also engaged in practice as a consulting engineer with an office in New York City and Charlotte, N. C.

For a number of years Mr. Lee has been active in the affairs of the American Institute of Electrical Engineers, being at the present time a fellow and a director. He has been a member for several years of the committee on power transmission and distribution, standards committee and committee on power generation, being at present a member of the latter two and of the Edison medal committee. Mr. Lee's other society memberships include American Society of Mechanical Engineers, American Society of Civil Engineers, Engineering Institute of Canada, American Electrochemical Society and the American Engineering Council.

STEFAAN PIEK of Buffalo, N. Y., was elected executive vice-president of the Utica (N. Y.) Gas & Electric Company at a meeting of the board of directors

held December 13. Prior to the designation of Mr. Piek the resignation of John S. Avery, vice-president and general manager of the company, was accepted. The directors named Alvan H. Stack general manager to succeed Mr. Avery.

H. E. CARTER, superintendent of the electric operating department of the Southern Public Utilities Company at Winston-Salem, has been transferred to the engineering and construction department of the general office at Charlotte.

J. R. HOFFMAN, who has been connected with the Belleville district of the Southern Illinois group of the Illinois Power & Light Corporation for the past thirteen years has been named manager at Jacksonville to succeed J. P. Alvey, who has assumed new duties in Ottawa.

V. P. MCNAMARA, for many years with the Puget Sound Power & Light Company in the sales department in different districts, and more recently in the rural electrification department as assistant to J. C. Scott, on October 1 joined the organization of the Portland Electric Power Company as rural service representative at Salem, Ore.

J. H. CHAPMAN, for eleven years light commissioner of Kansas City, Kan., has joined the Studebaker utility interests in Kansas and Missouri. Mr. Chapman will be a special industrial representative, assigned to the promotion of new industrial business for the various companies. The system comprises more than 300 companies. Most of Mr. Chapman's time will be spent in Topeka.

MARTIN FRISCH has joined the Foster Wheeler Corporation, New York City, in charge of engineering in the furnace and pulverizer division of the corporation. A wide experience during the past eight years has brought Mr. Frisch into intimate contact with many of the outstanding power plant developments of the country, particularly while managing service and field engineering work. More recently he was engineer in charge of development for Combustion Engineering Corporation.

L. J. COOPER, for the past five years district manager for the Arkansas Power & Light Company with headquarters in Pine Bluff, has been promoted to the managership of the Ozark division of the Arkansas Power & Light Company with headquarters at Harrison. Mr. Cooper became identified with the Arkansas utility in 1916. EVERETTE SADLER has been appointed to succeed Mr. Cooper in Pine Bluff.

EDWARD A. BRAND, formerly connected with the general offices of the New York Power & Light Corporation, has been transferred to Glens Falls as commercial manager of that division. Before affiliating himself with the upstate utility Mr. Brand was connected with the West Penn Power Company as assistant to the distribution manager in charge of lighting and wiring service department. He is a member of the National Electric Light Association's commercial and industrial lighting committee and is the N.E.L.A. representative on the National Fire Protective Association's electrical committee.

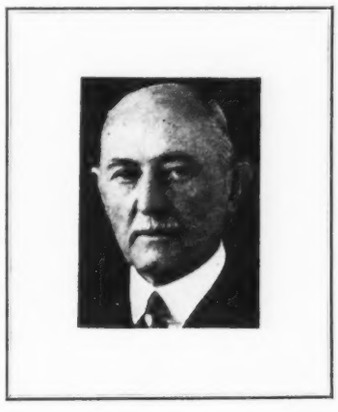
CHARLES D. LARIMER, formerly general manager of the Tazewell Street Railway and Tazewell Electric Light & Power Company, has been retained as local manager for the Appalachian Electric Power Company, which has acquired the local system.

E. C. ROHRBAUGH has been named by the Iowa-Nebraska Light & Power Company for the position of superintendent of plants in the Shenandoah, Iowa, district, where large additional facilities are being constructed. He succeeds Grady Fort, resigned.

Obituary

William A. Brackenridge

William A. Brackenridge, who resigned as senior vice-president and a director of the Southern California Edison Company about a year and a half ago, died November 29 in Santa Barbara, Cal., in his seventy-first year. An authority on water power of national



reputation, Mr. Brackenridge was identified with some of the most important developments in the United States in the course of his career. He had an unusually broad engineering background, having had the advantage early in his career of spending considerable time abroad in the investigation of engineering works in England, France, Germany and Switzerland.

Upon the completion of his technical training Mr. Brackenridge was employed in an engineering capacity on the rapid transit system in the city of New York, and for several years following he was connected with many important railroad construction projects in New York State. Upon his return from Europe he was connected with the Railroad Commission of Connecticut and was later associated with the board of consulting engineers then making plans for the development of the water power at Niagara Falls by the Niagara Falls Power Company, this engagement resulting in his appointment as engineer in charge of all construction by that company. During his engagement with the Niagara Falls Power Company he conducted a private practice as consulting engineer specializing in hydraulic development, investigating and reporting on more than a score of hydro-electric projects in various parts of the country. It was in 1909, following the completion of a special investigation for the Southern California Edison Company, that he joined the staff as vice-president and general manager, a position he retained until elected president in 1918. Early in 1920 he retired from the presidency, becoming senior vice-president, in which capacity he served until his resignation in June, 1928.

MAJOR JAMES F. CASE, well-known engineer and head of the Paris office of Stone & Webster, died suddenly December 14 at the Hotel Grosvenor, New York, in his sixty-second year. A native of Wisconsin and a graduate of the University of Wisconsin, Major Case had engaged in varied activities which took him to many parts of the world, including the Philippines, where he was director of public works for several years. He joined Stone & Webster in 1928 as head of the Paris office.

CHARLES RUMMEL, for the past fourteen years manager of the light and power department for the British Columbia Electric Railway Company in the Fraser Valley area, including the cities of New Westminster and Chilliwack, died recently in Burnaby, B. C., at the age of 61 after a prolonged illness. Mr. Rummel joined the organization of the predecessor of the present British Columbia Electric Railway Company as a clerk in 1892, at a time when the entire office staff numbered three.

DR. JAMES H. ROGERS, inventor and pioneer in underground and underwater radio communication, died suddenly in Hyattsville, Md., December 12 of heart disease. He was 79 years of age. More than 50 important inventions were accredited to Dr. Rogers, who was chief electrician in the Capitol at Washington from 1877 to 1883. He had many honors conferred upon him in the course of his career. The Maryland Academy of Science gave him its inventor's medal and the degree of honorary fellow; Georgetown University and the University of Maryland bestowed upon him the degree of doctor of science in 1919, and he was elected an honorary member of the National Inventors' Institute.

Financial and Statistical News

ADVANCE STATEMENTS of next year's power and light construction program received this week indicate an average increase exceeding 10 per cent over 1929 totals. One company has doubled last year's figure. New financing has been resumed on a substantial scale. Bond flotations are in the lead.

——BOTH THE STOCK AND THE BOND MARKETS reflect seasonal slackness. In the latter convertibles alone show buyer interest.

New Board to Be Elected by Foshay Stockholders

In his first statement to stockholders since his companies went into voluntary receivership on November 1, W. B. Foshay offered his services as majority stockholder to put the affairs of the companies in order and insure a speedy return to full solvency. After Mr. Foshay had presented his own resignation and that of other directors of the W. B. Foshay Company, it was decided to elect a board of directors through a mail poll of all stockholders. The poll is to be conducted immediately and formal election held at a meeting in Minneapolis on January 2. The request was made that Mr. Foshay and H. H. Hanley, vice-president of the Foshay Company, be retained on the board because of their familiarity with the company's affairs, and that the four other directors be chosen from among the preferred share owners.

Allis-Chalmers Increases Dividend

Directors of the Allis-Chalmers Manufacturing Company on December 6 declared a quarterly dividend of 75 cents per share on the common stock, no par value, payable February 15, 1930, to holders of record January 24. A quarterly distribution of 50 cents per share was paid on this issue on November 15 last.

Public Service of New Jersey Declares Extra Dividend

As was done at the close of business in 1928, the directors of Public Service Corporation of New Jersey, at a meeting held in Newark December 10 declared an extra dividend on the corporation's common stock. The extra dividend will be 80 cents per share and will be payable December 31 to stockholders of record December 20. At the same time the board adopted the policy of paying dividends in 1930 at the rate of $3.40 per share per year.

Pennsylvania Utility Increases Dividend

At the regular meeting of the directors of the Pennsylvania Water & Power Company, held November 27, the dividend for the last quarter of the year was increased from 62½ cents to 75 cents per share, placing the no-par stock on a basin of $3 a year. The dividend is payable January 2, 1930, to stockholders of record December 13, 1929.

Shift of Ownership of Nebraska Companies

During the year ended October 1, 1929, 40 Nebraska municipalities disposed of their electric light properties to private ownership, according to a compilation recently made by the Middle West division of the National Electric Light Association. Eight isolated privately owned plants were likewise sold. During the same period six small towns not heretofore served were reached by transmission lines.

The accompanying tabulation shows the changing ownership for the past three years. The figures must be read with some allowance, as the directory of 1929 is slightly more complete than that of 1926, and more towns have developed electric service.

During October service in three additional towns was taken over by private companies. Grant and Venango are now in the Western Public Service Company's system; Bancroft, formerly served through a municipal system, buying energy from the Iowa-Nebraska Light & Power Company, is now supplied directly.

Electric Service in Nebraska

	1929	1926
Total number of towns having electric service	551	518
Total number of towns where operator is a private company	347	242
Total number of towns where operator is a municipality	204	276
Total number of towns where municipality generates its own electricity	75	101
Total population of towns served by municipality	259,862	210,000
Total population of towns served by private companies	573,371	473,000

New Capital Issues

Illinois Power & Light Corporation
First and refunding mortgage gold bonds, series C.
Amount, $5,000,000.
Price, $94½ and interest, yielding over 5⅝ per cent.

Illinois Power & Light Corporation owns and operates electric light and power, gas, water, heat, city railway and bus properties in a large number of the most populous and prosperous municipalities in Illinois and owns or controls all of the common stock of several important subsidiary public utility companies. The equity behind these bonds is represented by $9,080,500 of debenture bonds, $4,650,000 of 5 per cent cumulative preferred stock, 410,000 shares of $6 cumulative preferred stock and 600,000 shares of common stock.

Wisconsin Power & Light Company
First lien and refunding mortgage gold bonds, series F.
Amount, $2,500,000.
Price, $96½ and interest.
Period, twenty-nine years.

Wisconsin Power & Light Company, a part of the Middle West Utilities System, supplies electric light and power service to 268 communities in central and southern Wisconsin. These bonds will be secured by a first mortgage on important divisions constituting approximately 45 per cent of the value of all properties now owned by the company and will be further secured by a direct mortgage lien on the remaining property, rights and franchises of the company now owned or which may be hereafter acquired, subject to certain outstanding securities.

Western Power, Light & Telephone Company.
Gold notes.
Amount, $2,500,000.
Price, $98.60 and interest, yielding 7 per cent.
Period, two years.

Western Power, Light & Telephone Company owns and operates, through subsidiaries, public utility properties in Missouri, Kansas, Oklahoma and Texas and ice properties in Kansas, Texas and New Mexico.

Standard Gas & Electric Company
Cumulative preferred stock.
Amount, 100,00 shares.
Price, $64.50, yielding 6.20 per cent.

Standard Gas & Electric Company's system comprises one of the largest public utility organizations in the country, its subsidiary and affiliated companies furnishing public utility service to 1,554 communities with an estimated population of 6,100,000 located in twenty states. More than 73 per cent of the present combined net earnings of the subsidiary and affiliated companies is received from the sale of electric energy for power and light, 12 per cent from gas, 11 per cent

from transportation and 4 per cent from miscellaneous services. Proceeds from the sale of these additional shares of $4 cumulative preferred stock will be used for investments in its subsidiary companies and for other corporate purposes.

Union Electric Light & Power Company
General mortgage gold bonds, series B.
Amount, $15,000,000.
Price, $100 and interest.
Period, thirty-eight years.

Union Electric Light & Power Company does substantially all the central station electric light and power business in the City of St. Louis and surrounding districts in Missouri. The total territory served by the company and its subsidiaries has an area of more than 2,700 square miles and a population estimated to exceed 1,300,000. These bonds are being issued to reimburse the treasury of the company for expenditures made for additions and extensions to its properties.

SERVEL TO INCREASE STOCK.—An increase in the authorized capital stock of Servel, Inc., from 1,600,000 shares to 2,000,000 shares has been approved by the stockholders. An increase in the authorized preferred stock from 10,000 shares to 65,000 shares was also approved.

Mortgage Bond Financing Resumed

First Issues Since the Market Break Make Their Appearance—Over $40,000,000 in Bond Issues Have Been Announced to Date

PREDICTIONS that new financing operations in the power and light field would swing over to bond financing are borne out. After a period of about six weeks, in which virtually no public financing was carried on in the industry, a number of new issues are making their appearance. Virtually all of them to date are in the form of bonds or notes.

During the past year there has been a decided swing to stock financing. Rights to buy common stock have been issued in large volume and the totals thus floated gave the financial structures of the public utilities so strong a common stock basis that bond financing was made feasible in a larger way. It seemed almost as though the financial executives of the utilities anticipated some such market situation as actually happened and prepared their structures for a period when common stock financing would be somewhat more difficult. In any event, the resumption of financing operations is almost entirely in the direction of senior financing.

Approached for his opinion of the form which 1930 financing operations in the utility field would take, an outstanding utility executive told ELECTRICAL WORLD that he believed that such operations would comprise a majority in the form of bond financing. He indicated also that the open end mortgage bond would be most popular and that costs of financing would be relatively low.

What this executive said is being borne out already. Among the six issues sold to date since the break, all are relatively long-term serial mortgage bonds, with the exception of one in the form of gold notes and one preferred stock issue. The largest issue, namely, that of the Detroit Edison Company, is characterized general and refunding mortgage gold bonds, series A. This is a 4 per cent issue, due 1949. An issue of $5,000,000 of first and refunding mortgage gold bonds was sold by the Illinois Power & Light Corporation.

The new issues are of an almost identical type. With the exception of one issue of short-term notes they all bear a 5 per cent coupon and are all serial. The majority are of 25 to 30 years' duration indicating that the terms have been regarded as favorable. The yield in most cases is between 5 and 5½ per cent, except in the case of the short-term notes which have a yield of 7 per cent. The bond issues are the old type bond issues, again without any special common stock flavor in the form of convertibility or warrants, which proved so popular prior to the market break. It is intimated that institutional buying of these issues was quite heavy.

The details of these new issues will be found elsewhere.

Rapid Development of Home Electrification in Berlin

Last year the Electricity Central Station of Berlin, in combination with the municipal gasworks, arranged a survey in order to ascertain the percentages of households using either gas or electricity as well as the number of domestic utensils in use in electrified homes.

The population of Greater Berlin, which is an agglomeration of eight towns, 59 villages and 27 other parts, represented by the 225 members of the municipal government, amounts to 4,200,000, this figure being equal to 1,300,000 households. Carefully prepared questionnaires, containing some 60 queries on gas and electricity, were sent out to each of these households and 1,246,680 returned them, 58,285 of which proved to be of no use, leaving a balance of 1,188,395 households whose replies gave a correct statement of the situation on October 10 of last year.

The results have now been tabulated and made available. Of 1,188,395 households mentioned, 536,860, or about 45 per cent, do not use electricity but most of them use gas, 255,590 of these households living in one-roomed, 213,020 in two-roomed, and 50,535 in three-roomed houses, flats or apartment houses; 651,535 households, or nearly 55 per cent, used electricity, 227,995 for lighting only and 423,540 for lighting as well as for domestic purposes.

The survey further shows that of every 100 electrified homes 55.95 are using electric irons, 27.50 vacuum cleaners, 16.25 heating pads, 16.45 heating and cooking as well as medical appliances, all other electric apparatus being far less generally used, refrigerators, for instance to an extent of only 0.17 per cent and water heaters 0.15 per cent.

A survey executed by the Berlin Central Station on May 3, 1925, shows that of the aforementioned 1,188,395 households only 27.4 per cent were electrified at the time, which reveals the fact that within 3½ years the number of Berlin households electrified has doubled.

RHODE ISLAND PUBLIC SERVICE INCREASES STOCK.—Stockholders of the Rhode Island Public Service Company on December 3 voted to authorize the issue of 600,000 additional shares of common B stock at $6 par value. This action will increase the authorized amount of this issue to 1,600,000 shares. The new stock will not be issued immediately, but from time to time by direction of the board of directors in such amounts as the directors shall determine, for the purpose of financing improvements in the company's service and equipment.

NEBRASKA POWER LAUNCHES CUSTOMER-OWNERSHIP CAMPAIGN. — The Nebraska Power Company has launched a customer-ownership sales drive in which it will offer through its employees and local trust companies 10,000 shares of its preferred stock, valued at $1,000,000, priced to yield 6 per cent. Proceeds will be used to finance its 1930 development campaign. This is the first public offering of securities made by the company since 1923.

CANADIAN COMPANY COMPLETES SUCCESSFUL CAMPAIGN. — Dominion Power & Transmission Company, Ltd., Hamilton, Ont., has just completed a successful customer-ownership campaign. On November 25 the company offered through its employees to its customers 10,000 shares of 7 per cent cumulative preferred stock at $105 a share. The campaign was advertised to last for two weeks, but within six days applications had been received from more than 2,450 customers. In its first customer-ownership campaign, three years ago, the company sold 8,600 shares of this stock to 1,850 customers.

MERGER OF CONNECTICUT UTILITIES ASSURED.—More than 70 per cent of the stock of the Stamford Gas & Electric Company has been deposited to be exchanged for shares of the Connecticut Power Company on the basis of four shares of the latter for one of the

former. The deposit of 70 per cent of the stock had been stipulated in the offer made by Connecticut Power through its president, Samuel Ferguson. The Connecticut Public Service Commission last week approved the proposed acquisition of the Stamford company.

AMERICAN SUPERPOWER TO PAY INITIAL DIVIDEND ON NEW STOCK.—Directors of the American Superpower Corporation have declared for the calendar year 1929 a cash dividend of $1 per share on the new common stock, payable January 2, 1930, to holders of record December 10, 1929. They also declared the usual quarterly dividend of $1.50 per share on the first preferred stock and preference stock payable January 2, 1930, to holders of record December 10, 1929, for the quarter ended December 31, 1929.

GERMAN UTILITY INCREASES CAPITAL.—Stockholders of the Rhine-Westphalia Electric Power Corporation have approved an increase in the capitalization from 181,000,000 to 243,000,000 marks and in the dividend from 9 to 10 per cent. Of the new capital, 2,000,000 marks were taken up by municipalities at 110 per cent, 29,270,000 marks were subscribed by a syndicate for an offering to stockholders at 130 per cent, on the basis of one new share for each six shares held, and 30,730,000 marks were taken at 110 per cent by the trustees, who have agreed not to dispose of their holdings without the approval of the company. Rights will be made available to American stockholders of record January 6, 1930, who will be entitled to subscribe at $31.20 a share to one new share for each six held. Rights will expire January 23. City Bank-Farmers Trust Company will act as depositary.

Distribution Leakages Must Be Stopped*

BY DR. JULIUS KLEIN
Assistant Secretary of Commerce

IT IS safe to assume that our production methods are far in advance of those of distribution in terms of real efficacy. Here is the biggest problem now confronting our business life, namely, the establishment of something like equilibrium or balance between these two major functions. This means a redoubled scrutiny of our whole distributive apparatus to make sure that at least some of its major and more flagrant discrepancies are remedied.

In every business crisis the first instinct is for a hasty jettisoning of whatever happens to be loose around on deck of the distressed vessel. Usually the things last loaded into the cargo are the ones first seized upon for this purpose regardless of the fact that there may well be some far less desirable items which ought to be the first to go overboard.

And so in the present situation, if difficulties are encountered by any of our distributors, they are apt to abandon first of all those recently acquired items in their expenditures which lie in the field of research and accelerated advertising. So much has been said in the past few years regarding the necessity of more statistical apparatus, closer market analyses, more intelligent stimulation of demand in potential trade areas that budget items for analysts, for advertising counselors, have of late been climbing upward—and quite rightly so. It would, however, be the height of ill-advised snap judgment to cut down immediately upon these items of expenditure simply because they happen to be among the last to be undertaken during the recent periods of prosperity. Now is just the time when they are most needed.

We must analyze distribution, not as the work of a series of nicely segregated distinct groups, but as an essentially unified process whose functional details rather than individual participants should be the object of our present approach to the problem. In other words, our microscope should be focused not so much on chain stores or independents and the explosive wordy war that is being waged between them, but rather upon the broad problems of inventories, of credit policies, of returned goods, of delivery services of trade terms, and similar major aspects of distribution as a whole.

ACCURATE RECORDS LACKING

Perhaps the primary requirement of our distributive machinery, the factor in which seems to center a major portion of existing difficulties, a chief cause why retailers go wrong—and wholesalers and even larger elements—is the lack of accurate records. It is amazing to see how early in the course of any given clinic on the ills of any one establishment or group establishments the unpleasant truth comes out that the executive in charge "didn't know this was going on": he had "no idea how much this was really costing him"; he never knew until it was too late the appallingly high percentage of his charge accounts as against those of his more successful competitor, which were turning into bad debts.

Another functional aspect of distribution which certainly must be promptly and vigorously attacked is credit structure. For instance, of our annual retail business of about forty billion dollars, it has been figured that 60 per cent involves some form of selling on credit. This includes four or five billions of installment sales. Here we have a formidable sum whose mere proportions would seem to command immediate and respectful consideration and yet we are only beginning to develop the actual facts on this staggering mass of distributional activity. The national retail credit survey which the Department of Commerce is now carrying on in collaboration with the Retail Credit Men's Association and other agencies is making material headway in this much needed analysis. All it can do, however, is to reveal the facts. It will then be up to the individual merchant to apply them to his own problems.

TEST OF INSTALLMENT SALES

In this connection, our installment selling operations, which form the basis of so many industries, are likely to undergo their first real test in the situation. We are likely to discover just what proportion of this system has resulted from excessive extensions.

The returned goods evil is another phase of our distribution system which should be much more carefully scrutinized. Isolated efforts have been made to clarify this problem, but there has as yet been no concerted drive upon it. In one large eastern city about forty million dollars' worth of goods is involved in this manner each year. The returns, according to the Department of Commerce nation-wide credit survey, run as high as 20 to 25 per cent of total sales in the case of charge customers in department stores as against only 6.8 per cent of the goods sold for cash. The abuse of this privilege leads, of course, to many losses—the time of clerical help, complicated accounting, excess delivery service back and forth, and above all the absence of salable goods from the shelves for periods of several days.

Our major wastes in distribution probably occur among the ranks of small retailers. Countless hundreds of these unfortunates are not in a position to ascertain all of the essential facts upon which successful business must be built. They are apt to be entirely ignorant of the costs of doing business. In connection with the forthcoming distribution census it is hoped that illuminating details will be revealed as to some of these elements. But since the data are to be supplied by the retailers themselves, we can only hope for the best.

It would seem, therefore, to be most timely to spread far and wide the not entirely pleasant, but apparently necessary tale of the perils of retailing. Here is a crusade against waste which is certainly worthy of the efforts not simply of chambers of commerce, but of Rotarians, Kiwanis Clubs and others interested in alleviating misery of all sorts. It is peculiarly the responsibility of the local banker.

From an address before members of the McGraw-Hill Staff, December 15.

SHAWINIGAN WATER & POWER DECLARES LARGER DIVIDEND.—Directors of the Shawinigan Water & Power Company have declared a quarterly dividend of 62½ cents a share on the capital stock, no par value, payable January 10 to holders of record December 20. Previously, the company paid quarterly dividends of 50 cents a share.

Business News and Market Conditions

N.E.L.A. Convention Will Have No Exhibition

After considerable discussion as to whether or not an exhibition would be held by manufacturer members at the 1930 N.E.L.A. convention in San Francisco, it was found that adequate facilities were not available. The Civic Auditorium is adequate for the convention itself, but lacks additional suitable space for a creditable and effective exhibition of the industry products.

At the N.E.L.A. national executive committee meeting in Chicago the situation was fully discussed with representatives of the Pacific Coast utilities and a tentative agreement was reached to proceed. After further conferences the chairman and secretary of the committee, accompanied by A. Jackson Marshall, secretary of the N.E.L.A., visited San Francisco with developed plans and specifications.

It was found, however, that the expense to the industry involved in providing facilities for an exhibit would be exceedingly high and a final decision was made that no exhibit will be held.

Utilities Use More Copper

Five hundred thousand tons of copper, or 50 per cent of that produced in the United States, will have been consumed this year by the public utilities and electric manufacturers, Paul S. Clapp, managing director of the National Electric Light Association, told the American Mining Congress in Washington recently.

The construction program of electric light and power, street railway and telephone and telegraph companies and the electric manufacturing industry for 1930 should prove very encouraging to the copper mining industry, he said. Next year the electric light and power companies alone will spend $865,000,000 for new construction, an increase of $65,000,000. It is anticipated that 60 per cent of the amount will be for extension of transmission and distribution facilities utilizng much copper.

America Will Lead in Export of Equipment

Indications are that the end of 1929 will see the United States in the position of world supremacy in the export of power plant equipment, a place heretofore occupied by Germany. The total German exports in this line amounted to the equivalent of $128,000,000 in 1928 and is not expected to exceed this figure by any great extent this year. The government's figures show, on the other hand, that at the present rate the American exports will exceed this figure materially.

Domestic manufacturers have always controlled the world markets in lesser electrical appliances. In the matter of large generators, transformers, switchboards and other equipment that goes into power stations, however, they have been somewhat at a disadvantage because material of this type cannot be produced on a large scale.

In government circles the expected ascendency of American manufacturers into first place in the export of heavy electrical goods is regarded as particularly significant. It means, according to foreign trade experts, that American capital has gone before and initiated power development. Where American capital has gone, American equipment will follow, it is pointed out, not only because of the contacts between those interested in the developments and the manufacturers, but also because of frequent financial connections.

As far as any great need of foreign markets is concerned, the electrical manufacturing industry has less reason to worry than most other lines of trade, it is felt in official quarters.

Copper Market Marks Time

Last week's slight improvement in the volume of copper sales was short-lived. The volume of business this week dropped back to an average of but little over 300 tons a day again. Prices remain unchanged.

New York Metal Market Prices

	Dec. 11, 1929 Cents per Pound	Dec. 18, 1929 Cents per Pound
Copper, electrolytic	18	18
Lead, Am.S.& R.price	6.25	6.25
Antimony	8¼	8¼
Nickel, ingot	35	35
Zinc, spots	6.35	5.85
Tin, straits	39¼	40⅛
Aluminum, 99 per ct.	24.30	24.30

Census of Distribution Will Be Nation-Wide

The Department of Commerce will shortly take a nation-wide census of distribution, the first ever attempted. It will cover every dealer in the country. Questions asked will cover all phases of business, including volume of sales and expense. No attempt will be made to arrive at profits. Information asked is required by law but held confidential by the Census Bureau.

Each of about 2,000,000 wholesalers, retailers and others will be asked some 200 questions. Also, several questions about distribution will be asked of all manufacturers.

"Distribution," says the Department of Commerce, "is the most important problem of modern business. Here are the great possibilities of profit or loss, and increased efficiency. A complete revolution in wholesaling and retailing practice is taking place under our eyes, but the problem is so vast and our information so meager that the extent and direction of these changes is only guesswork. Greater knowledge of tendencies and conditions as they now exist is needed to help the distributors avoid inefficiency and to keep the pace with modern practices in manufacturing."

The enumeration will include:

1. A count of the number of distributors classified geographically by kind of merchant (retailer, wholesaler, agent, etc.); class of business (dry goods, hardware, etc.); volume of sales; and character of ownership (individual, corporate, co-operative, chain, etc.).

2. Volume of sales classified geographically by classes of commodities; outlets; etc.

3. Inventories; date of establishment of business; employees, by sex, seasonal variation, full-time and part-time employment; wages and salaries; rent, interest and other expenses paid; credit and installment sales; receipts from service operations; etc., all these classified geographically by kind and class of distributor, size of establishment, and with each other, in all significant combinations.

Delinquent Electrical Accounts

NUMBER OF ACCOUNTS REPORTED

Division	October 1928	October 1929	Per Cent Increase or Decrease	Ten Months 1928	Ten Months 1929	Per Cent Increase or Decrease
New York	271	259	— 4.4	2,940	2,515	—14.4
Middle and Southern Atlantic	199	156	—21.6	1,925	1,645	—14.5
New England	122	108	—11.5	1,316	1,332	+ 1.2
Central	653	869	+33.	7,550	6,523	—13.6
Total	1,245	1,392	+11.8	13,731	12,015	—12.5

TOTAL AMOUNTS REPORTED

	October 1928	October 1929	Per Cent Increase or Decrease	Ten Months 1928	Ten Months 1929	Per Cent Increase or Decrease
New York	$41,362	$35,394	—14.4	$425,304	$536,750	+26.2
Middle and Southern Atlantic	28,230	20,651	—26.8	247,810	222,512	—10.2
New England	18,063	18,095	+ 0.17	164,422	189,550	+15.3
Central	74,909	92,989	+24.1	889,063	774,205	—12.9
Total	$162,564	$167,129	+ 2.8	$1,726,599	$1,723,017	— .2

British Electrical Trade More Successful Abroad

Although in the past year British electrical manufacturers have secured a record number of important orders abroad, domestic trade is still in a depressed condition. The fact that the industry has secured export contracts in excess of those for any previous year is due to the increasing speed of electrification in every important market of the world.

Britain is now engaged in carrying out a national electricity scheme, and in the past year about 5,000,000 hp. of transforming plant has been ordered by the Central Electricity Board. Two new super-power stations for this scheme have been opened at Ham's Hall, Birmingham, and Portishead, Bristol, with an aggregate capacity of 100,000 kw. Extensions to and equipment of five new stations under the scheme, amounting to 350,000 kw., have also been carried out.

Market Conditions

ABUNDANT RAINFALL has relieved the threatened water famine in the Pacific Coast area. December equipment business there has been above normal. Elsewhere throughout the country seasonal slackness exists. Next year's plans are most encouraging but orders therefrom are materializing slowly.

——THE SOUTHWEST AND MIDDLE WEST REPORT ORDERS of at least normal proportions, with prospects of better business early in 1930.

——NEW ENGLAND AND THE SOUTHEAST REPORT ORDERS numerous but individually small.

EASTERN

THERE is little change in the situation in the electrical equipment market in the Eastern district, with the exception of brighter prospects for early transactions for 1930 expansion and improvement programs.

INQUIRIES for this account up to the present time are of minor character, considering the large appropriations planned by utility companies and industrials for such work.

THE BULK of immediate business is divided between central stations and railroads; industrial demand is quiet.

An Eastern steam railroad has given a contract to a New York maker for substation equipment, including switchboards, motors and accessories for electrification work, to cost approximately $150,000, and a second award to the same company for a quantity of insulation materials to cost about $300,000. A West Virginia steam line has placed an order with a Pennsylvania manufacturer for switchboard panels and apparatus. Inquiries are said to be on the way for oil-electric locomotive units for several roads; the Philadelphia & Reading Railway is scheduling the purchase of about 100 multiple-unit electric steel passenger coaches in 1930, each car to weigh about 140,000 lb. and seat 84 passengers. Other important commitments will be made by this road for equipment for its electrification program.

A manufacturer of high-tension insulators reports a good volume of incoming business of rather widely distributed character; the outlook is good. A power company in South New Jersey has contracted with a New York manufacturer for a quantity of transformers, switchgear and accessory equipment to cost close to $100,000. A central station in Ohio has placed an order for automatic switching equipment, transformers, lightning arresters and affiliated apparatus to cost $35,000. A large producer of coal in the Pennsylvania field says that present demand from power companies is the heaviest in months, with industrials, as well, taking increased quantities; mines are working at twice the capacity of this time a year ago. A manufacturer of industrial motors reports full production at plant in the Middle West, with orders maturing at a rate to insure this basis of output for some weeks to come; the outlook for early commitments for spring deliveries is considered excellent. Another maker of industrial equipment, electric welding apparatus, says that business is satisfactory, with an exceptionally heavy call from the oil industry; inquiries are holding strong and some sizeable orders have been secured for January deliveries. Wire and cable account shows improvement; the call from central station companies is heavier in volume, as well as in extent of orders. A manufacturer of electrical instruments in New Jersey states that general demand shows a falling off during the past few weeks, with radio account maintaining exceptional activity. A Michigan producer of electric refrigerating units reports good business, with prospects bright for continuance; shipments during November show an increase of more than 125 per cent over the corresponding month of a year ago, and plant is running on a capacity basis.

CONSTRUCTION PROJECTS

R. Hoe & Company, New York, have filed plans for an addition to printing press manufacturing plant to cost $125,000. The General Electric Company, Schenectady, N. Y., will build an addition to plant at Fort Wayne, Ind., to cost $250,000. The American Cigar Company, New York, has filed plans for a factory at Louisville, Ky., to cost $250,000, and will make improvements in present plant at that place to cost $50,000. The Erie Railroad Company, New York, is said to be planning the rebuilding of wheel shop and other shops at Port Jervis, N. Y., recently destroyed by fire with loss of about $100,000. The American Can Company, New York, is considering extensions and improvements in plant at Ogden, Utah, reported to cost in excess of $100,000. The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has awarded general contract for superstructure for first unit of proposed factory branch and distributing plant at Newark, N. J., to cost $700,000. The duPont Viscoloid Company, Arlington, N. J., is carrying out an expansion and improvement program at non-shatterable glass plant, reported to cost $500,000. Swift & Company, Chicago, Ill., will build a meat-packing plant at Philadelphia, Pa., to cost $100,000. The Charles J. Webb Sons' Company, Philadelphia, Pa., has filed plans for a textile plant to cost $250,000. The Coatesville Boiler Works, Coatesville, Pa., contemplates an addition to cost about $100,000. The Tarentum Steel Corporation, Tarentum, Pa., will begin work in January on a plant to cost $500,000. The Consolidated Gas, Electric Light & Power Company, Baltimore, Md., plans extensions and improvements in power plants and power substations to cost close to $1,000,000. The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until January 7, for 77,000 feet of insulated cable for the New York and Mare Island navy yards (Schedule 2457); and until January 14, for 30 motor-driven ventilating sets and 30 sets of spare parts for the Mare Island yard (Schedule 2469). The Potomac Electric Power Company, Washington, D. C., plans power substation reported to cost $250,000.

NEW ENGLAND

HEAVY industrial equipment interest slackened during the past week, although a number of large projects in which electrical machinery will be required during the coming year are being considered. One of these is a 45,000-kw. generating plant in a southern location; another includes electrical equipment for a large paper mill in northeastern New England.

Turbo-generator sales recently reported by one prominent manufacturer include small units, one of which was of 250 kw. and another 600 kw. Small motors are in fair demand and scheduled materials are steady. A slight falling off in demand is reported for this month to date. Negotiations for electrical heating furnaces are being received.

Outside line material and central-

station supplies are quiet. A number of new lines are projected, one of which is a 40-mile transmission line for northeastern Maine. Electric wiring contracts are numerous and notably sizable. Among these is one recently announced for a large government hospital, several for institutions and two large commercial building contracts. Merchandising is strong. Appliance sales are gaining and the past week, according to one group of prominent stations, shows 25 per cent increase over the previous year, with cleaners, irons and radio particularly active.

CONSTRUCTION PROJECTS

George Lawley & Sons' Corporation, Neponset, Mass., plans rebuilding of shipbuilding plant recently destroyed by fire with loss of $100,000. United States Rubber Company, Providence, R. I., has filed plans for two additions to factory to cost $100,000. New York, New Haven & Hartford Railroad Company, New Haven, Conn., plans power plant for shop service to cost more than $400,000.

Pacific Coast

DECEMBER business in the Southern section of the Pacific district is excellent in every electrical branch, especially in buying by power companies. Motor and apparatus sales in Seattle and Puget Sound cities continue light.

OPTIMISM, however, prevails as indications for good business next year are bright, particularly from central-station and industrial sources.

Business includes $25,000 worth General Electric reactors, $60,000 worth of Westinghouse transformers for central California distribution, four carloads pole line hardware for San Joaquin Valley, two carloads bare copper wire, $4,000 worth of ground rods and heavy stock ordering of high-tension tubes, construction tools and lead-covered cable. Portland reports a $4,000,000 power company budget for 1930, based largely upon a 46,000-hp. steam turbine plant in Portland proper and a 40,000-hp. hydro-electric plant on the Clackamas River. The outstanding order covers $200,000 worth of power transformers, for San Joaquin Valley installation. Industrial machinery business includes a 400-hp. General Electric motor and equipment valued at $4,000 for a lumber camp in the redwood belt, $20,000 worth of Westinghouse elevator motors and equipment for a Los Angeles steel company, $35,000 worth of Westinghouse mine hoist equipment for Arizona and one carload of rigid iron conduit for a signal company. Lighting business has improved. Retail stores report very late but also very heavy buying, retail prices are fairly firm and railroad buying is reaching a new high.

Orders in the Puget Sound area include one from a timber company at Everett for approximately $40,000 worth of motors, ranging from 500 hp. down and contracts are expected to be let early in January. One jobber reported the sale of twenty machines from 75 hp. down to a sawmill and woodworking plant; another, three 1,250-kva. transformers, 25 15-kva. transformers and about ten motors from 40 hp. down; another order was for four 200-hp. motors to an Oregon sawmill and another eight machines from 200 hp. down to a pulp and paper mill. The city of Seattle bought two 1,200-amp. oil circuit breakers, some glass insulators and carriage bolts and will shortly call for bids for about $2,000 worth of 300,000- to 750,000-circ.mil asbestos-covered station cable. The city of Seattle on December 20 will open bids for 32 cast-iron light standards costing about $50 each.

CONSTRUCTION PROJECTS

Pacific Gas & Electric Company, San Francisco, Calif., will install an ornamental lighting system at Auburn, Calif. Los Angeles, Santa Cruz, North Hollywood and Seabastopool, Calif., and Hood River and Pendleton, Ore., plan ornamental lighting systems. Board of Control, Tacoma, Wash., will receive bids until January 2, for transformers, switchboards, instruments, etc., for Cushman Project No. 2. Tacoma, Wash., contemplates a steam-operated electric power plant for auxiliary service to cost more than $100,000. Independent Petroleum Company, Tacoma, Wash., plans oil storage and distributing plant to cost $100,000. McGoldrick Lumber Company, Spokane, Wash., will carry out an expansion and improvement program to cost $100,000. Idaho Power Company, Boise, Idaho, is arranging expansion and improvement program in power plants and transmission lines to cost more than $500,000. University of Utah, Salt Lake City, Utah, is asking bids until December 27 for a 130-hp. reaction turbine, 80-kw. generator and complete auxiliaries for new hydraulic laboratory building. Southern Colorado Power Company, Pueblo, Colo., plans extensions and improvements in power plants at Pueblo, Skaguay and Canon City, Colo., to cost about $150,000.

Southwest

BOTH manufacturers and jobbers report a marked increase in sales during the past week and predict that December will show a good volume of business in all electrical lines.

The following orders for machinery and equipment have been placed: A 2,000-kw. turbo-generating unit with jet condenser for an industrial plant, to cost $50,000; underground cable amounting to $35,000; wire conduit and fittings to cost $8,000 were ordered for a new factory on the Illinois side which is to make electrical conduit; substation and equipment costing $16,000 for a fire brick factory; poles, cable and fixtures for two white-way jobs, each to cost $6,000.

CONSTRUCTION PROJECTS

St. Louis, Mo., will soon take bids for a vocational high school to cost $900,000. Joplin, Mo., is said to plan installation of floodlighting system and beacon lamps at municipal airport. Tulsa, Okla., plans signal system for fire department to cost more than $400,000. Tulsa, Okla., plans installation of floodlighting system and beacon lamps at municipal airport to cost $600,000. Swift & Company, Chicago, Ill., meat packers, etc., will proceed with superstructure for a produce plant at Ardmore, Okla., to cost $150,000. Camden, Ark., contemplates an improved lighting system on all principal streets. Central Power & Light Company, San Antonio, Tex., has authorized construction of transmision line from Marfa to Fort Davis, Tex. Port Arthur, Tex., plans floodlighting system and beacon lamps at proposed municipal airport to cost $500,000. Louisiana Power & Light Company, New Orleans, La., contemplates extensions in transmission lines to cost more than $250,000. Beaird Corporation, Shreveport, La., contemplates extensions and improvements in welding plant to cost $100,000.

Middle West

RETAIL trade has felt the stimulation of holiday buying with the resulting increase in sales.

RAILROAD equipment purchasing has been a valuable factor in establishing favorable conditions and it is expected that the railroads will continue with their proposed expenditures.

ELECTRICAL industry continues optimistic, although conservative, toward future business with a large amount of work contemplated.

There has been a good demand for major apparatus with a sustained demand for distribution equipment. Some of the interesting orders placed this week include one for extension of present substation to cost $45,000, one for 820 Thompson meters 5 to 6,000 amp. capacity, 60 current transformers 100 to 2,000 amp. capacity and several construction orders aggregating $60,000. Jobbers' sales so far this month are up to expectations. Present figures indicate a large holiday season with a good demand for electrical merchandise of every description.

CONSTRUCTION PROJECTS

Milwaukee Electric Railway & Light Company, Milwaukee, Wis., has plans maturing for addition to steam-operated electric power plant to cost $4,000,000. Marquette University, Milwaukee, Wis., contemplates engineering building on the campus, estimated to cost $700,000. Little Wolf Power Company, New London, Wis., plans early construction of hydro-electric power plant on Little Wolf River to cost $350,000. Hayes Body Corporation, Grand Rapids, Mich., plans addition to automobile body plant to cost $200,000. Packard Motor Car Company, Detroit, Mich., plans multi-story service, repair and sales building at Chicago, Ill., to cost $125,000. St. Joseph Electric Steel Castings Company, St. Joseph, Mich., plans expansion and improvement program to double present capacity to cost $100,000. Homer Furnace Company, Coldwater, Mich., plans rebuilding of portion of heating equipment manufacturing plant recently destroyed by fire with loss of $250,000. Liquid Carbonic Company, Chicago, Ill., plans bottling machinery manufacturing plants at Los Angeles, Calif., and Seattle, Wash., reported to cost $200,000. International Harvester Company, Chicago, Ill., will soon begin erection of factory branch and dis-

tributing plant at San Antonio, Tex., to cost $100,000. City Light Company, Fort Wayne, Ind., plans extensions and improvements in plant and system to cost $300,000. American Steel & Wire Company, Cleveland, Ohio, will make extensions and improvements in local Newburg plant to cost $10,000,000. Republic Stamping & Enameling Company, Canton, Ohio, plans expansion and improvements in plant to cost more than $150,000. Toledo, Ohio, plans central station for police and fire alarm systems, estimated cost $300,000. Minnesota Valley Canning Company, Blue Earth, Minn., plans addition to cost $425,000. Montana-Dakota Power Company, Minneapolis, Minn., contemplates steam-operated electric power plant at Williston, N. D., to cost $250,000. Chicago, Burlington & Quincy Railroad Company, Chicago, Ill., plans enlargement of stock car-building plant at Omaha, Neb., to cost $200,000, and will build addition to box car-building plant at Lincoln, Neb., to cost more than $100,000. Iowa Railway & Light Corporation, Cedar Rapids, Iowa, plans hydro-electric power plant to cost $1,700,000.

SOUTHEAST

EXCEPT in few instances orders of outstanding size have dried up. The volume of small orders is satisfactory and general business is about as normally expected in this period of the year.

A central station in Louisiana ordered street-lighting equipment amounting to $25,000 and this is the only large order reported for the week. A Georgia company's distribution and small power transformer purchases aggregated $10,600, while its insulator orders totaled approximately $9,000. Hot dip galvanized conduit amounting to $8,500 was also ordered in Georgia. Some other central-station orders were for $3,200 worth of street-lighting equipment, $2,000 of distribution transformers and $1,800 of creosoted pine poles.

Inquiries are out on four 6,667-kva. transformers for installation in Georgia. Two orders amounting to $6,000 each were placed by Louisiana plants for industrial and substation equipment in connection with gas and oil development activities.

CONSTRUCTION PROJECTS

Shenandoah River Power Company, Harrisonburg, Va., is arranging plans for hydro-electric power plant on Shenandoah River to cost more than $500,000. Harpers Ferry Electric & Power Company, Harpers Ferry, W. Va., plans extensions in transmission lines and distributing system to cost $150,000. Tennessee Eastern Electric Company, Johnson City, Tenn., plans extensions in transmission lines and distributing system to cost more than $60,000. Firestone Tire & Rubber Company, Akron, Ohio, plans factory branch and distributing plant at Nashville, Tenn., to cost $200,000. Watertown, Tenn., plans a municipal electric lighting plant. Birmingham, Ala., contemplates installation of floodlighting system and beacon lamps at proposed municipal airport to cost $1,000,000. Tampa, Fla., contemplates installation of floodlighting system and beacon lamps at municipal airport to cost about $700,000.

Activities of the Trade

Westinghouse Electric Supply System Is Launched

A GROUP of nineteen wholesale electrical supply companies doing a total annual business of $60,000,000, with branches in 60 cities, have been organized by the Westinghouse Electric & Manufacturing Company into a single system under the name of the Westinghouse Electric Supply Company.

The new system includes the following units:

Alpha Electric Company, New York City and Brooklyn; Commercial Electrical Supply Company, St. Louis and Memphis; Commercial Electric Supply Company, Detroit, Grand Rapids and Flint; Electric Appliance Company, Dallas, Houston, Tulsa, San Antonio, Harlingen and Oklahoma City; Fobes Supply Company, Portland and Seattle; Fobes Supply Company of California, San Francisco and Oakland; Fobes Supply Company of Montana, Butte and Spokane; Great Northern Electric Appliance Company, St. Paul, Duluth, Minneapolis, Fargo; H. C. Roberts Electric Supply Company, Philadelphia, Baltimore, Washington, Wilmington, Reading, York, Allentown and Trenton; H. C. Roberts Electric Supply Company, Inc., Syracuse, Utica, Albany and Binghamton; Illinois Electric Company, Chicago and Peoria; Illinois Electric Company of California, Los Angeles, Long Beach, Phoenix; Julius Andrae & Sons Company, Milwaukee, Waterloo, Madison, Des Moines and Mason City; McGraw Division of Julius Andrae & Sons Company, Omaha and Sioux City; Newark Electrical Supply Company, Newark; Pierce Electric Company, Jacksonville, Tampa and Miami; Erner Electric Company, Cleveland; F. Bissell Company, Toledo; Varney Electrical Supply Company, Indianapolis and Evansville; Wetmore-Savage Electric Supply Company, Boston, Bangor, Providence, Springfield, Worcester.

Previous to the reorganization, these companies were owned by the Westinghouse Commercial Investment Company, a subsidiary of the Westinghouse Electric & Manufacturing Company, but conducted business under their own names and with their own corporate organization.

One of the objectives of the new system is to secure greater efficiency in the distribution of electrical products and to this end central reserve warehouses are being established in Boston, New York City, Syracuse, Philadelphia, Tampa, Detroit, Indianapolis, Chicago, St. Paul, St. Louis, Dallas, Los Angeles, Portland, Ore., and Seattle, which will serve all of the sixty houses and will make available for quick delivery a broader line of merchandise than it has been possible to carry in the individual warehouses. All houses will, however, continue to carry all electrical and radio merchandise in general demand, as heretofore.

The new plan of organization also makes possible the more efficient handling of the requirements of national customers, such as the large utility companies and industrial organizations, which require service in a number of cities but which frequently purchase through one central puchasing office. For this purpose the Westinghouse Electric Supply will maintain general sales offices at the New York headquarters and at 20 North Wacker Drive, Chicago.

The headquarters offices of the Westinghouse Electric Supply Company are located at 150 Broadway, New York. The officers are A. W. Robertson, chairman of the board, and Walter Cary, president. The operating executives are John J. Gibson, vice-president; B. W. Clark, general manager; A. J. Selzer, director of sales and purchases; Walter Dick, auditor, and W. J. Jockers, general sales manager.

TIME-O-STAT CONTROLS COMPANY has recently completed two new wings in its plant at Elkhart, Ind., thus adding 79,000 additional square feet of space. Production demands since the summer constantly have called for increases in the working force.

SERVEL SALES, INC., announces the appointment of F. P. Shea as assistant sales manager of Servel Electric refrigeration with headquarters at Evansville. Mr. Shea was connected with the Copeland Refrigerator Company before entering the employ of Servel in 1928 as a division manager.

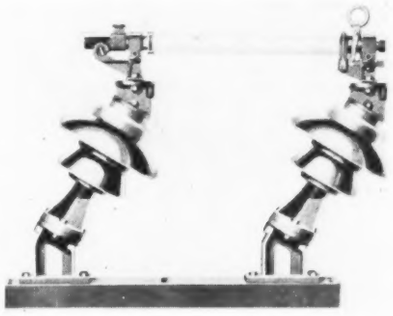
U. S. ELECTRICAL MANUFACTURING COMPANY, outgrowing its manufacturing quarters located in Los Angeles, has increased its administration and engineering departments by the addition of another wing and new equipment has been installed so that the production of U. S. motors has been increased approximately 50 per cent.

GENERAL REFRACTORIES COMPANY, Philadelphia, Pa., has recently appointed the Harris Pump & Supply Company, 319-21 First Avenue, Pittsburgh, Pa., as its high temperature cement dealer representative in the Pittsburgh district. Its territory will cover the western half of Pennsylvania, going as far east as Williamport. It will also cover the northern part of West Virginia, going as far west as Tyler County and east to Hardy County. It will also include the eastern edge of Ohio, covering the counties of Trumbull, Mahoning, Columbiana, Jefferson and Belmont. It will also include the western end of Maryland, covering the counties of Garrett and Alleghany.

New Equipment Available

Heavy-Duty High-Tension Fuse

A new line of high-tension fuses in which the insulator units are interchangeable with the previous lines of high-tension equipment is announced by the Line Material Company, South Milwaukee, Wis. These fuses are made



in ratings of 7,500 volts and 15,000 volts, with a maximum rating of 100 amp., and are also made in ratings of 25,000 volts and 37,000 volts, up to and including 50 amp. maximum rating.

The new line differs in general construction from the previous line; the catch for locking the cartridge in the closed position prevents blowing the cartridge out of contact on a heavy short circuit. The catch is held by a bronze spring and cannot be disengaged except by bringing the ring handle downward. The mounting is made from galvanized steel channel drilled at each end for two mounting bolts. The contact clips are of copper with the outer reinforcing phosphor bronze clips. This insures ample and uniformly distributed pressure.

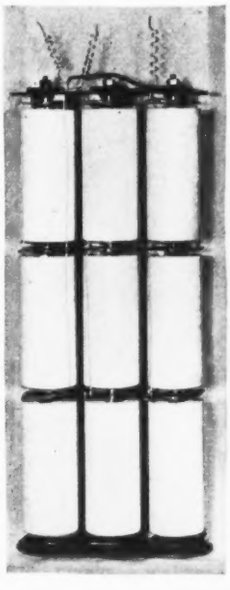
The top contacts are full floating, while the lower contacts are fixed, which compensates for cartridge variations, according to the manufacturer.

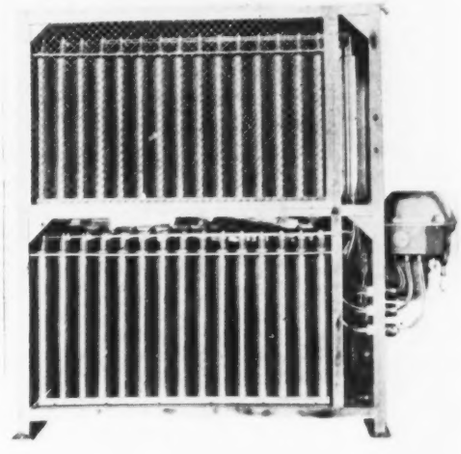
Cell-Type Capacitor as Power-Factor Corrective

To meet the increasing demand for power-factor corrective devices, the Electric Machinery Manufacturing Company of Minneapolis has developed an improved line of cell type capacitors. The EM capacitors are available for standard voltages and frequencies and for single-, two- or three-phase circuits.

Each cell contains nine capacitor rolls and is a complete unit. The desired kva. is obtained by connecting the required number of cells in parallel. The capacitor "working units" are wound in cylindrical form, with interleaving layers of high-grade tissue and aluminum foil. After treating and impregnating, the rolls are rigidly mounted on a supporting rack and sealed under oil in a welded sheet steel cell. The rack mounting of rolls prevents any undue mechanical pressure on the paper and allows free circulation of the oil. Each roll is provided with a cut-out, so that the injury of the unit roll will not interrupt the operation of the capacitor.

Three frame styles for capacitor units are used, depending upon the rating of the capacitor. Capacitors 30 kva. and over are mounted in double-deck stands. For capacitors under 30 kva. single-deck stands or frames are used. Individual cell type capacitors for small induction motor correction are frequently furnished where individual motor correction is desired. Stands of welded steel angle and T-bars form supporting structure for capacitor cells.

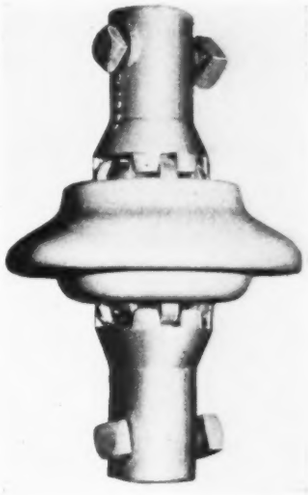




The illustration shows a standard cell for three-phase or single-phase operation on the left, and on the right a 360-kva., 2,300-volt, three-phase, 60-cycle, cell type capacitor for indoor use.

Insulating Pole-Top Switches

For insulating the moving shafts of gang-operated pole-top switches, the Champion Switch Company, Kenova, West Va., has developed the high-



strength porcelain unit shown. To the upper and lower surfaces are secured fittings which can be readily attached to the switch-operating pipe.

Group-Control Rocking-Insulator Disconnect

The Pacific Electric Manufacturing Corporation of San Francisco announces its new type "S" switch, which is a development of the standard type "K" switch.

The outstanding improvement in the type "S" design is the new rocker bearing and rocker shaft mounting, a distinct improvement and a feature possessed by no other rocker switch design, according to the manufacturer. The shaft in this design does not pass through the bearings, but is bolted in place after the switch units are installed. The switch units, therefore, can be hoisted in position, assembled and ready to operate.

Inequalities of supports or insulator variations can be simply equalized in the three units. The shaft acts as a counterweight to the insulators, and as the bearing areas are small the switch operates with remarkable smoothness and ease, the powerful leverage of the control easily cracking away any ice or sleet. A non-ferrous pin in the rocking member turns in a free galvanized hole in the rocker bearing, thus eliminating lubrication. This switch is equipped with self-aligning full-floating contacts like other Pacific Electric Manufacturing Corporation switches.

Electrical Patents

Announced by U. S. Patent Office

(Issued November 19, 1929)

1,736,097. GROUNDING BOX; J. J. Skickluna, Buffalo, N. Y. App. filed June 17, 1926.

1,736,101. STORAGE-BATTERY SEPARATOR AND RETAINER; W. B. Stone, Webster, Mass. App. filed Sept. 16, 1926.

1,736,115. STORAGE BATTERY COVER; B. Ford, Philadelphia, Pa. App. filed June 30, 1925.

1,736,116. FILLING VENT STRUCTURE FOR STORAGE BATTERIES; B. Ford, Philadelphia, Pa. App. filed March 29, 1926.

1,736,126. IGNITION DEVICE FOR FUEL-SUPPLY DEVICES; S. G. Miller, Los Angeles, Calif. App. filed Feb. 11, 1926.

1,736,129. ELECTRICAL SWITCH; L. A. M. Phelan, Beloit, Wis. App. filed Dec. 1, 1922.

1,736,145. FASTENING FOR THREADLESS PIPES; E. G. K. Anderson, Evanston, Ill. App. filed April 20, 1928.

1,736,148. ELECTRIC STEAM-PRESSING APPLIANCE; C. A. Brewer, Darien, Conn. App. filed Sept. 15, 1926.

1,736,149. CONDUIT FITTING; R. P. Dunmire, Erie, Pa. App. filed Oct. 31, 1925.

1,736,150. CONDUIT FITTING; R. P. Dunmire and D. E. Kellogg, Erie, Pa. App. filed Oct. 30, 1925.

1,736,152. TOGGLE SWITCH; O. H. Frank, Brooklyn, N. Y. App. filed Aug. 6, 1927.

1,736,154. PIPE CONNECTER; W. Goetzelman, Chicago, Ill. App. filed Feb. 20, 1926.

1,736,198. ELECTRIC CIRCUIT MAKER AND BREAKER; A. P. Holden, and P. Morgan, Toronto, Ont., Can. App. filed June 29, 1925.

1,736,211. OIL WELL HEATER; J. A. Miller, Chicago, Ill. App. filed Oct. 20, 1927.

1,736,217. ELECTRIC CONTACT IN RAIL JOINTS; C. Pascal, Montreal, Quebec, Can. App. filed Aug. 30, 1922.

1,736,269. SEPARABLE ELECTRICAL CONNECTER; A. L. Lawrence, Cleveland, O. App. filed Sept. 29, 1923.

1,736,285. INDICATING PULL SOCKET; H. Hubbell, Bridgeport, Conn. App. filed Sept. 21, 1926.

1,736,323. SYNCHRONOUS DRIVING DEVICE; S. A. Murdock, Los Angeles, Calif. App. filed July 30, 1925.

1,736,369. ELECTRICAL SWITCHING MEANS; J. Sachs, Hartford, Conn. App. filed July 29, 1922.

1,736,370. INCLOSED ELECTRIC SWITCH; J. Sachs, Hartford, Conn. App filed Aug. 7, 1923.

1,736,371. AUTOMATIC CIRCUIT BREAKER; J. Sachs, West Hartford, Conn. App. filed Dec. 19, 1924.

1,736,372. AUTOMATIC CIRCUIT BREAKER; J. Sachs, West Hartford, Conn. App. filed July 28, 1922.

1,736,379. WIRE CONNECTER; W. R. Sommer, Hackensack, N. J. App. filed April 1, 1925.

1,736,401. MOTOR CONTROLLER; P. B. Harwood, Milwaukee, Wis. App. filed July 19, 1928.

1,736,428. PORTABLE WELDING APPARATUS; H. E. Bryant, Providence, R. I. App. filed Feb. 10, 1926.

1,736,434. PHASE-SEQUENCE RELAY; C. LeG. Fortescue, Pittsburgh, Pa. App. filed July 31, 1924.

1,736,435. PROTECTIVE SYSTEM FOR ELECTRICAL APPARATUS; C. LeG. Fortescue, Pittsburgh, Pa. App. filed Sept. 26, 1925.

1,736,438. TIME-DELAY LOW-VOLTAGE RELEASE; L. C. Frank, Wilkinsburg, Pa. App. filed Nov. 2, 1927.

1,736,441. MAGNETO; I. E. Hendrickson, West Springfield, Mass. App. filed Aug. 31, 1928.

1,736,443. MOTOR-CONTROL SYSTEM; E. P. Hill, Manchester, England. App. filed June 27, 1925.

1,736,444. METHOD FOR MAKING INSULATED ELECTRICAL CONDUCTORS; T. B. Huestis, Bristol, R. I. App. filed Aug. 5, 1924.

1,736,451. ELECTRIC OVEN; R. H. MacInnes, Chicago, Ill. App. filed Aug. 29, 1927.

1,736,452. SAFETY SWITCH STRUCTURE; J. F. MacWilliams, Cresson, Pa. App. filed March 21, 1928.

1,736,454. THEATER-LIGHTING CONTROL APPARATUS; J. C. Masek, Irwin, Pa. App. filed June 10, 1927.

1,736,455. INSULATOR; J. E. Mateer, Wilkinsburg, Pa. App. filed July 15, 1927.

1,736,456. CATHODE-RAY OSCILLOGRAPH; A. Matthias, Berlin-Wilmersdorf, Germany. App. filed April 10, 1928.

1,736,459. TAP-CHANGER MECHANISM; K. A. Oplinger and L. H. Hill, Sharon, Pa. App. filed Nov. 19, 1926.

1,736,471. REGULATOR SYSTEM; C. F. Wagner, Pittsburgh, and R. D. Evans and S. B. Griscom, Wilkinsburg, Pa. App. filed June 10, 1925.

1,736,477. REGULATOR SYSTEM; E. R. Wolfert, Wilkinsburg, Pa. App. filed Feb. 17, 1928.

1,736,480. ELEVATOR-CONTROL SYSTEM; E. M. Bouton, Chicago, Ill. App. filed Nov. 17, 1927.

1,736,481. MOTOR-CONTROL SYSTEM; E. M. Bouton, Chicago, Ill. App. filed Nov. 17, 1927.

1,736,487. TOY RAILROAD TRACK; J. Cooper, Evanston, Ill. App. filed March 7, 1927.

1,736,493. SWITCH; K. F. Gallimore, Fond du Lac, Wis. App. filed Jan. 18, 1926.

1,736,500. METHOD OF AND APPARATUS FOR CONTROLLING VIBRATORY SYSTEMS; J. W. Legg, Wilkinsburg, Pa. App. filed Sept. 23, 1927.

1,736,512. LAMP-HANGER STRUCTURE; A. J. Thompson, Cleveland, O. App. filed May 26, 1926.

1,736,528. ELECTRIC SWITCH; F. W. Gay, Newark, N. J. App. filed Dec. 8, 1927.

1,736,534. TIRE-DEFLATION SWITCH; B. C. S. Jensen, Fredericksberg, and J. P. Petersen, Copenhagen, Denmark. App. filed Jan. 20, 1927.

1,736,539. WELDED AND CALKED BODY AND PROCESS OF PRODUCING SAME; M. Lachman, New York, N. Y. App. filed Oct. 14, 1927.

1,736,544. CIGAR LIGHTER; H. E. Mead, Detroit, Mich. App. filed Aug. 24, 1927.

1,736,571. SAW; D. Beisinger, New York, N. Y. App. filed Sept. 21, 1926.

1,736,587. ELECTRIC FURNACE; J. J. Frank, Pittsfield, Mass. App. filed Dec. 21, 1927.

1,736,605. TESTING DEVICE; F. E. Kreft, Chicago, Ill. App. filed Nov. 27, 1925.

1,736,617. MECHANICALLY-OPERATED BUTT WELDER; J. A. Muir, Detroit, Mich. App. filed Nov. 11, 1926.

1,736,613. ELECTRIC ADVERTISING DEVICE; G. McCoshen, Boonton, N. J. App. filed May 1, 1928.

1,736,618. REGULATION OF DYNAMO-ELECTRIC MACHINES; C. A. Nickle, Schenectady, N. Y. App. filed Nov. 10, 1925.

1,736,623. BATTERY-POST TERMINAL CLAMP; H. A. Rennhack, Ottawa, Ont., Can. App. filed Sept. 7, 1927.

1,736,662. APPLIANCE FOR INTERNAL COMBUSTION ENGINES; F. Münz, Stuttgart, Germany. App. filed Aug. 20, 1926.

1,736,683. SWITCH; C. S. Wakeland, Wayland, Ky. App. filed Dec. 10, 1927.

1,736,689. SPEED CONTROL SYSTEM; E. F. W. Alexanderson, Schenectady, N. Y. App. filed March 26, 1928.

1,736,746. PENDANT SWITCH; P. McShane, Pittsburgh, Pa. App. filed July 18, 1928.

1,736,761. ELECTRICAL DOOR LOCK; C. Haffner, Allentown, Pa. App. filed Feb. 18, 1929.

1,736,764. ELECTRICAL CONDENSER AND METHOD FOR MAKING THE SAME; H. F. Schecker, Brooklyn, N. Y. App. filed Feb. 28, 1929.

1,736,766. APPARATUS FOR MAKING INCANDESCENT LAMPS; W. R. Burrows, Newark, N. J. App. filed June 14, 1922.

1,736,767. METHOD OF MAKING INCANDESCENT LAMPS; W. R. Burrows, Newark, N. J. App. filed July 27, 1925.

(Issued November 26, 1929)

1,736,779. CONNECTING BLOCK FOR ELECTRIC LIGHT CLUSTERS; V. R. Despard and H. C. R. Popp, Valparaiso, Ind. App. filed June 3, 1927.

1,736,783. MEASUREMENT OF ELECTRICAL RESISTANCE; L. A. Gary, San Francisco, and H. G. Tasker, Los Angeles, Calif. App. filed July 17, 1928.

1,736,811. ELECTRICAL CONDENSER; B. V. Wysocki, Berlin-Lichtenfelde, Germany. App. filed March 29, 1927.

1,736,816. ALTERNATING CURRENT RELAY; M. L. Almquist, Brooklyn, N. Y. App. filed March 23, 1927.

1,736,823. CONDENSER; C. A. Birchfield, Larchmont, N. Y. App. filed Sept. 12, 1925.

1,736,831. SINGLE FLUSH RECEPTACLE; H. J. Morey, Syracuse, N. Y. App. filed March 7, 1925.

1,736,832. MANUFACTURE OF ARTICLES FROM MOLTEN CARBON; S. Münch, Wolfen, Kreis Bitterfeld, Germany. App. filed Feb. 24, 1926.

1,736,844. BRUSH HOLDER; A. E. Buchenberg, Toledo, O. App. filed June 21, 1919.

1,736,854. WELL DRILLING APPARATUS; D. L. Johnson and W. H. Barnes, Tulsa, Okla. App. filed Dec. 5, 1927.

1,736,857. ELECTRODEPOSITING APPARATUS; W. W. McCord, Wyandotte, Mich. App. filed July 6, 1926.

1,736,860. ADVERTISING DEVICE; J. E. O'Brien, Brooklyn, and T. F. O'Brien, Richmond Hill, N. Y. App. filed Dec. 1, 1927.

New Trade Literature

MINE AND INDUSTRIAL SAFETY.—The Mine Safety Appliances Company, Pittsburgh, Pa., has just issued its new No. 4 general catalog of 160 pages, covering "Everything for Mine and Industrial Safety." This new catalog contains an unusually large number of illustrations, many of which are reproduced in colors. The cover is brown Buckeye stock, embossed in silver and black lettering.

OIL-ELECTRIC LOCOMOTIVE.—Ingersoll-Rand Company has just issued a 38-page booklet entitled "The Oil-Electric Locomotive," which traces the growth and development of the oil-electric locomotive within the span of a few years. This booklet is attractively made up and copiously illustrated with diagrams and pictures.

BAILEY METER GENERAL BULLETIN.—Bailey Meter Company of Cleveland, Ohio, is distributing a general bulletin which briefly describes all products of its manufacture. The products listed are automatic control, boiler meters, multi-pointer gages, tachometers, fluid meters, both the mechanically and electrically operated types; temperature and pressure recorders, steel meter boards, feedwater regulators, pressure reducing valves, drainage controls, pump governors, copper tubing and compression fittings, Selsyn-operated devices, Weir meters, gas meters, gravity recorders for liquids and coal meters. This four-page bulletin contains fifteen illustrations as well as references to other bulletins which give complete information on the various products.

SELSYN-OPERATED DEVICES.—Selsyn-operated devices for remote indication and record of liquid level, flow, pressure, temperature, draft, position and other factors, is the title of the twelve-page bulletin No. 110 issued recently by the Bailey Meter Company of Cleveland. This catalog explains how the Selsyn motor, a device which is in use on the more modern battleships for directing and controlling gun fire, has been applied to the long-distance transmission of various indications and records. Photographs, drawings and diagrams illustrate the principle of operation and the numerous applications in which this simple and reliable system of long-distance transmission may be used. The application of the Selsyn motor to control systems is also explained in this bulletin.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Agency is sought in Stuttgart, Germany (No. 42,624), for advertising signs.

Agency is sought in Montevideo, Uruguay (No. 42,640), for storage batteries, flashlights and farm lighting sets.

Agency is sought in Johannesburg, South Africa (No. 42,643), for batteries and flashlights.

Agency and purchase are sought in Nottingham, England (No. 42,752), for battery chargers.

Agency and purchase are sought in Sofia, Bulgaria (No. 42,721), for electromedical apparatus.

Agency is sought in Calcutta, India (No. 42,636), for flashlights.

Agency is sought in Berlin, Germany (No. 42,666), for electrical household appliances.

Agency is sought in Berlin, Germany (No. 42,710), for electrical household appliances.

Agency and purchase are sought in Bombay, India (No. 42,720), for street-lighting fixtures.

Purchase is sought in Rosario, Argentina (No. 42,757), for fractional-horsepower motors.

Agency and purchase are sought in Sofia, Bulgaria (No. 42,721), for electric motors and generators.

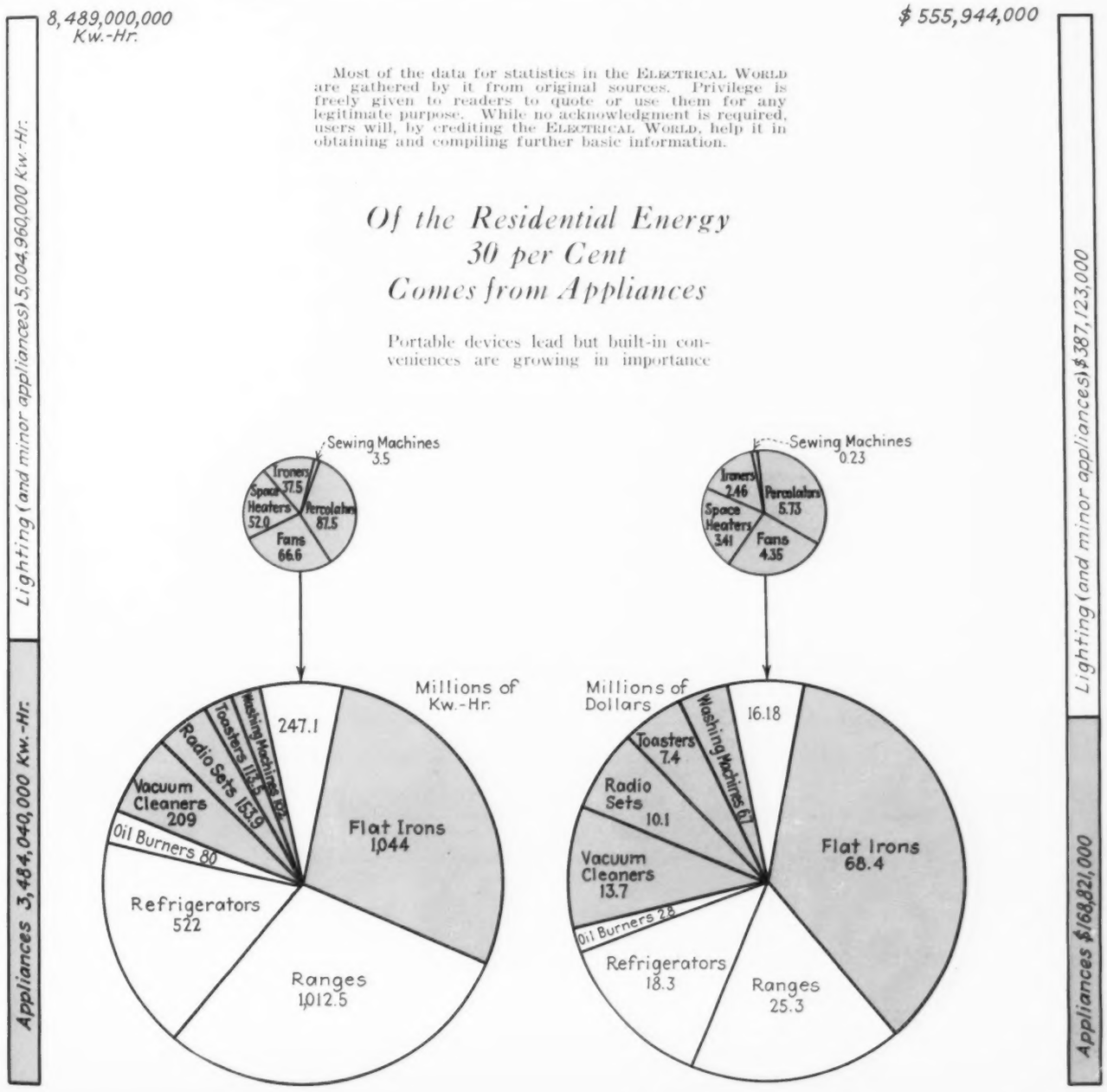
Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Appliances Take a Third of Domestic Energy Sales

ELECTRIC appliances produced fully a third of the revenue received by electric light and power companies last year for domestic energy sales; that is, about $169,000,000 out of a total of $556,000,000. They consumed 3,500,000,000 kw.-hr., in round numbers, of the 8,500,000,000 kw.-hr. that was used in American homes.

As the charts show, ranges, refrigerators and oil burners—or what may be called the stationary appliances—now loom large, but nearly three-quarters of the appliance revenue still comes from the portable group—those that can be plugged in at any receptacle. No account is here taken of the 55,000,000 portable lamps, which are included in the lighting load. How far this part of the market is from saturation is shown on the following page.


8,489,000,000 Kw.-Hr.
$ 555,944,000
Lighting (and minor appliances) 5,004,960,000 Kw.-Hr.
Appliances 3,484,040,000 Kw.-Hr.
Lighting (and minor appliances) $387,123,000
Appliances $168,821,000
Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers to quote or use them for any legitimate purpose. While no acknowledgment is required, users will, by crediting the ELECTRICAL WORLD, help it in obtaining and compiling further basic information.
Of the Residential Energy
30 per Cent
Comes from Appliances
Portable devices lead but built-in conveniences are growing in importance
Sewing Machines 3.5
Ironers 37.5
Space Heaters 52.0
Percolators 87.5
Fans 66.6
Millions of Kw.-Hr.
247.1
Flat Irons 1,044
Ranges 1,012.5
Refrigerators 522
Oil Burners 80
Vacuum Cleaners 209
Radio Sets 153.9
Toasters 113.5
Washing Machines 52
Sewing Machines 0.23
Ironers 2.46
Percolators 5.73
Space Heaters 3.41
Fans 4.35
Millions of Dollars
16.18
Flat Irons 68.4
Ranges 25.3
Refrigerators 18.3
Oil Burners 2.8
Vacuum Cleaners 13.7
Radio Sets 10.1
Toasters 7.4
Washing Machines 5.1

More Appliances in the Home

ABOUT 19,000,000 homes had electric service at the beginning of this year. At present the number exceeds 19,500,000. On the preceding page it is shown that a considerable portion of the electric energy purchased by them went into the operation of appliances.

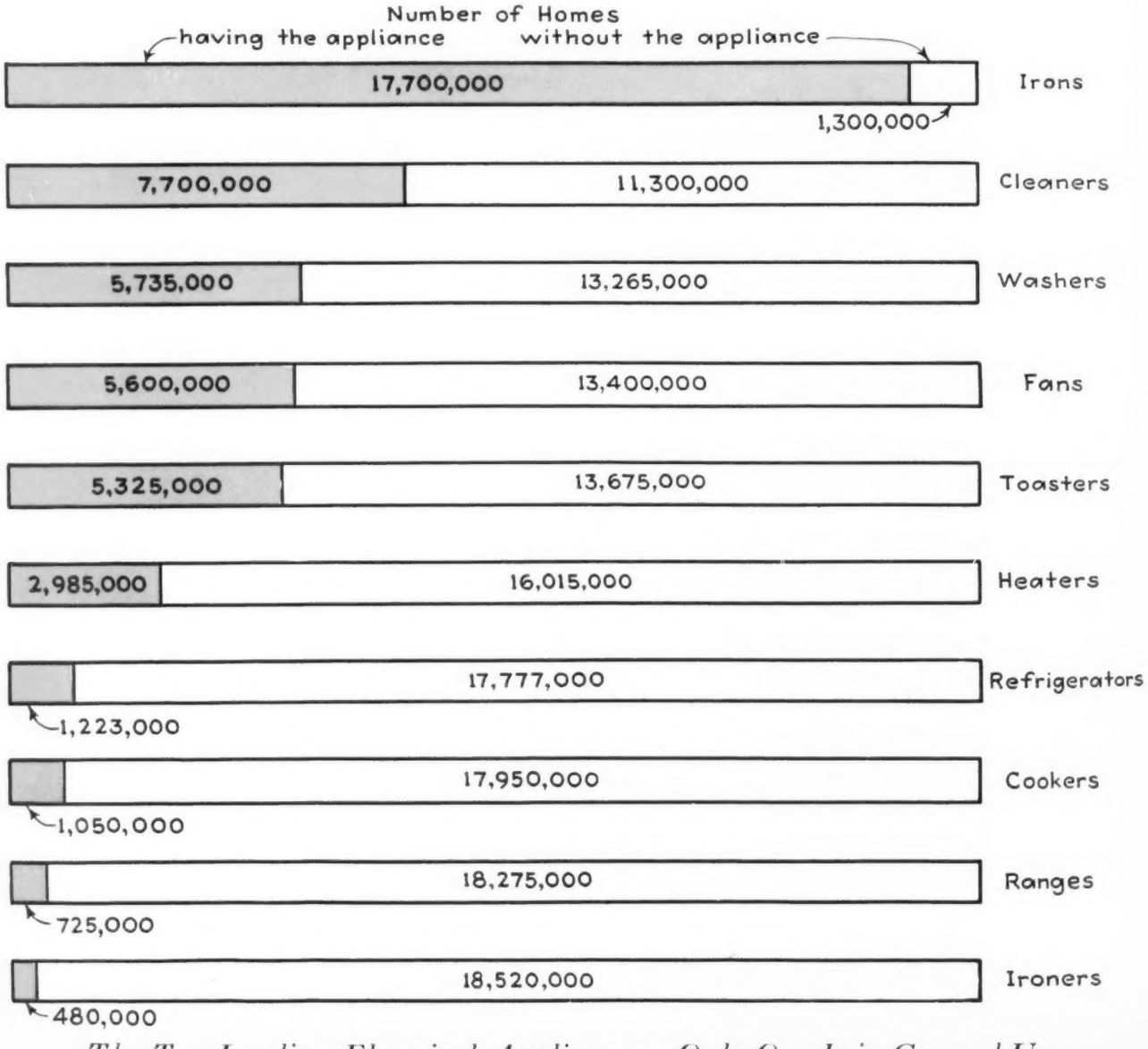
These estimates, recently published by the National Electric Light Association and based on a survey of appliances in use, made by *Electrical Merchandising*, account in part for the increasing consumption per customer that has been noted year by year. No doubt some of that increase is due to the gradual improvement in home lighting, which in former days constituted the whole domestic load and in which there are still great possibilities.

But the appliance load gives immediate promise of further large growth. Only in the case of flat-irons may the use be called general. No other electrical convenience is found in even half of our electrified homes.

The possibilities are evident from the chart. One home in four has a washing machine, a fan or a toaster. The use of heaters and electric refrigerators, despite the rapid introduction of the latter, is still more restricted.

Not every home, of course, is an immediate prospect for some of these devices, but the trend toward the expanding use of things electrical and the large number of homes in which most of them are not yet to be found point to a great potential market of interest to manufacturers, dealers and power companies.

Nor are the accessories to be overlooked. Fifty million is a big number, yet that is only the total of heating and mechanical appliances now used. Add the 55,000,000 portable lamps and we get a total exceeding a hundred million. How many feet of cord, how many plugs and receptacles, how much wiring was necessary to put them into service? What is required, annually, to replace wear and tear? These questions are more easily asked than answered. They are worth pondering over by men in every branch of the electrical industry.



The Ten Leading Electrical Appliances. Only One Is in General Use